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MODEL AIRPLANE NEWS

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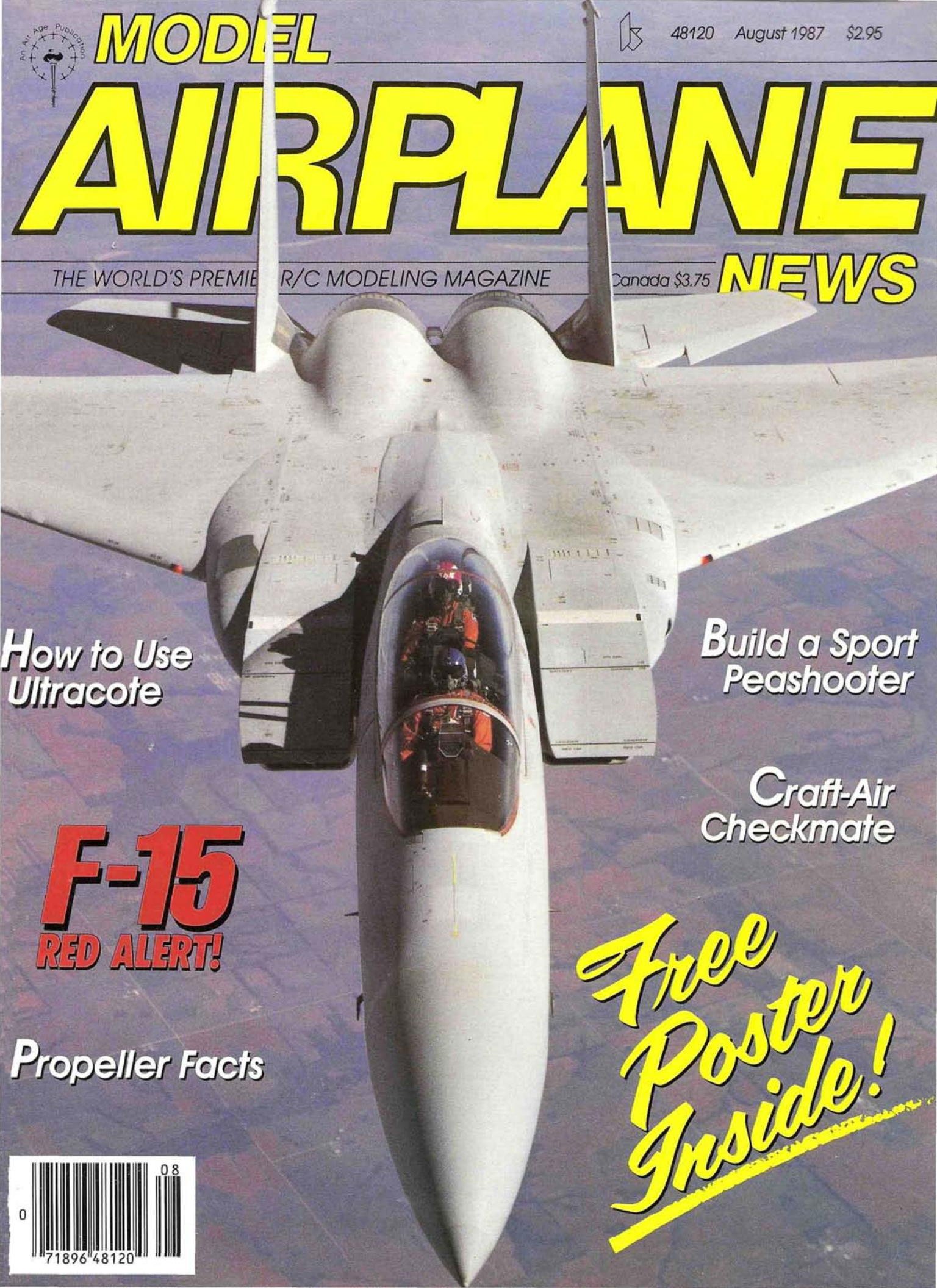

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AUGUST 1987 VOLUME 115, NUMBER 2

MODEL AIRPLANE NEWS

ON THE COVER AND ABOVE: Screaming through the stratosphere in "low-level" form is the specter that haunts Soviet air power, the indomitable F-15 Eagle, capable of ionospheric flight. See the Byron review on page 60 and Budd's well-observed analysis of the strategic importance and capabilities of the F-15 fighter. Photos are courtesy of McDonnell Douglas.

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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MODEL AIRPLANE NEWS
The world's premier R/C modeling magazine

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Editorial

by RICH URAVITCH

BET YOU GUYS ARE SURPRISED to find me up here in the front of the book, huh? Well, fact of the matter is that I complained about being squeezed in between the engines and the plans so the publisher decided to let me fill this space, which I hope to continue.

We've got a number of things planned which the team here at Air Age will help implement. We're a young group with a lot of collective experience and one of our near-term objectives is to make this publication even better by providing more informative, and therefore more valuable, articles.

One of our obligations to the readers is not only to recognize but, hopefully, react to his or her input. A common opinion, expressed by a significant number of modelers, gives us a real feel for what direction one should be heading with *Model Airplane News*. While the opinion may not necessarily represent a majority of modelers, it's enough to get our attention.

One of these attention-getters is the area of product reviews. Some of you have suggested that product reviews presented by virtually ALL the modeling publications are, to varying degrees, extensions of the manufacturer's ad programs. Some publications go so far as accepting and printing reviews prepared by the manufacturer's designated representatives. Kind of like asking Lee Iococca to do a road test on a LeBaron! We've all read reviews of products that we've also used and wondered if the author had used the same product. Right? Well, we're going to change the flavor a bit and the format somewhat to try to include a bit more substance and information in future reviews. With the cost of everything rising, we recognize our obligation to present the reader with decision-assisting information BEFORE he lays down the sometimes big bucks. This obviously won't happen overnight, but stick with us.

P.S. We apologize to you helicopter buffs for not having any helicopter features in this issue. Two of our contributing helicopter authors, for reasons beyond their control, were not able to meet the deadline. Please be assured there will be many articles to come and this exclusion will not be repeated. *LVD*

Airwaves

Experience Speaks

I'm ten years old and I really love R/C cars, boats, and especially planes. I have a control-line plane but I've never had a radio-control model. I'm getting a glider that's radio-controlled and I'm writing to find out if it's a good idea. Do you think I should start off with that or a car or boat?

ADAM BUNKELMAN
Ida, MI

Thanks a lot for your letter, I found it very interesting since you're starting out much like I did when I was very young. As I understand it, you've already flown U-Control models—the sort you control with two lines and a handle. If this is the case, you'll have had plenty of practice in starting small engines.

Not everyone will share my opinion, but I think that starting off in R/C flying with a glider is a good idea. Gliders tend to fly slower and give you a little more time to think about what's happening and react in the proper manner. There's sometimes a little problem with launching one however—that problem's finding enough open space! The usual method is to kite the model up on a strong cord tow line. This requires about 600 to 800 feet of space. The other method is to use a small engine mounted above the glider (or the nose if it's so designed). One such powered glider is the Craft-Air Butterfly. The engine eliminates the need for a long, smooth field since it can be hand-launched.

Whatever method you decide to use when learning to fly, by far the easiest way is to make sure to join a club. Without the help of a club, your R/C career is going to be a series of wrecks which is an expensive way to learn! In addition, be sure to enroll in the Academy of Model Aeronautics (AMA) so that you're covered by insurance. If you don't happen to know the whereabouts of your nearest R/C club, check with your local hobby shop; the owner generally knows who the club officers are and how to contact them.

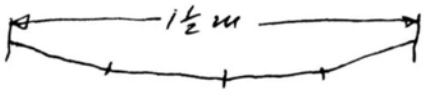
Let me wish you all the best in your new hobby. Through model aviation I've met a lot of great and interesting people. And the grounding I received through models led me to a very successful career in the Air Force.

Best wishes and many happy landings.
Jim Newman

Tip To Tip

In the June '87 issue there were two articles on hand-launched R/C gliders. Both were well done, but one area was misleading to your readers.

AMA Class A is for 1½-meter wingspan, this measures 59.05 inches, not 60 inches which was mentioned in both articles. The measurement is made on the wing from tip to tip in its flying configuration, not flat. And it's done with a jig



for all classes of sailplanes. (I measured wings at the '85 Nats with AMA jigs.)

The point of all this is that anyone going to a sanctioned contest in Class A won't be able to fly unless they cut off a bit from each wing tip—a problem which can be avoided if they know the correct span beforehand.

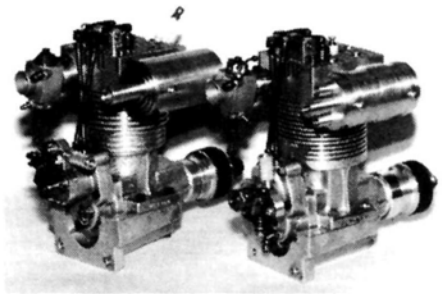
TED DAVEY
Malvern, PA

Thanks, Ted, for possibly saving a grief-stricken future competitor. *CC*

Engines And Bipe

Enclosed are two pictures. The biplane was built in 1986. It has a top wingspan of

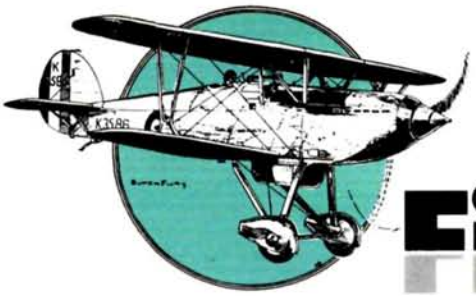
72 inches and is 54 inches long. The wing area is about 1,250 square inches, and it weighs about 13 pounds. I scratch-built it to fit my home-built four-cycle engine. I'm not a draftsman, but I manage to make basic drawings and sketches. I have spent most of my time building engines, both two- and four-cycle. Some were



published in *M.A.N.* in September '83 and December '85. Unfortunately, I happen to live in Taiwan which is very distant from the United States where all the action is.

JOHN M. KAMAR
Taipei, Taiwan

We welcome your comments, opinions, and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 632 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and length.



Fifty Years Ago...

by ART SCHROEDER

MANY AIRPLANE modelers today feel their hobby/sport is under constant attack, and is little known and generally misunderstood by most people. There is substantial reason for these feelings and the same was true fifty years ago this month.

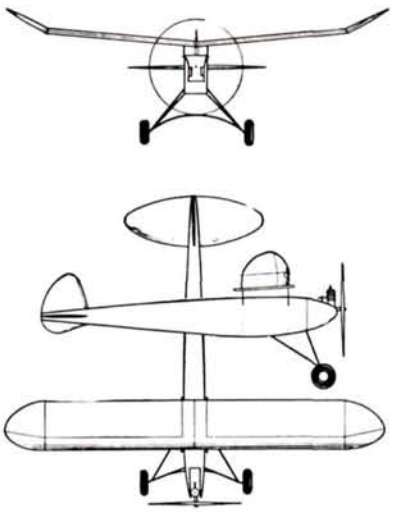
In an editorial entitled "We Shall Not Scrap Our Gas Jobs," Charles Hampson Grant exposed an organized opposition to gas model flying based on presumed dangers to property, people, and full-scale aircraft. There were those who would ban the activity. In part, the growing attacks and opposition spurred the development of the International Gas Model Airplane Association (IGMAA) as organized by *Model Airplane News.* Mr. Grant's editorial outlined ways the IGMAA membership could combat negative efforts against their activity. All remain valid today: educational value, stress safety practices, modeler support of organizations and clubs, strict modeler adherence to applicable laws and regulations, and presentation of a positive image at all public gatherings.

Certainly we can learn from the experiences of 1937—the more things change, the more they remain the same. Fifty years later we still must protect our right to enjoy model aviation.

Joe Kotula, the famed cover artist for *M.A.N.,* began a series on "Heroic Exploits of Aviation." Also that month Lt. C.C. Champion's 1927 record-breaking flight to 38,418 feet in a Wright Apache biplane was covered.

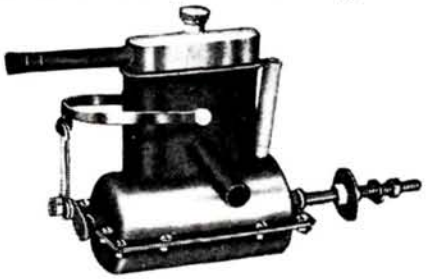
This Lockheed substratosphere aircraft was designed to fly at altitudes of up to 6 miles. The aircraft was of course pressurized.

Air transport was in a period of intensive development with large, multi-engined aircraft from Boeing, Lockheed, Junkers, Douglas, and Martin. Some of these designs became the basis for bombers in the impending war. Large flying boats were still being produced, but the future of long-range air travel seemed headed for land-based airplanes. Surely the stage was set for an efficient global air system.



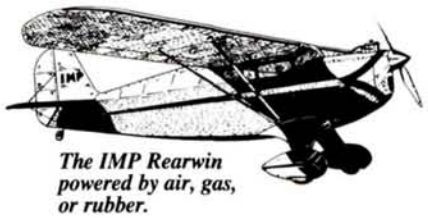
The Flying Midget was powered with a Brown engine and had only 300 square inches.

Maxwell Bassett was one of 1937's best-known gas model fliers as a direct result of winning Texaco, Mulvihill, Stout, and Moffett trophies with his novelty entry at the 1932 Nats. That "novelty" was, of course, a Brown-engine-powered free flight. That this feat turned our modeling world upside down is well known. Rubber power as "king" was finished. Bassett's personality and successes were profiled in the feature story in the August 1937 issue. It was an exciting time for model aviation as all set out to better the flying Philadelphian.



This is the IMP S-2 Tornado compressed-air motor.

Published that month was a small gas model of only 300-square-inch area. Despite that, the Flying Midget carried a Brown engine in its nose and was part of the trend toward smaller gas free flights. I gather it wasn't a big winner but it did hold claim to a new record. It was claimed that this airplane was the first to ever be "taken into or out of a moderately crowded (New York) subway car as one unit." As I said, it was an exciting time for model aviation and *Model Airplane News,* in its ninth year of publication, was there. ■



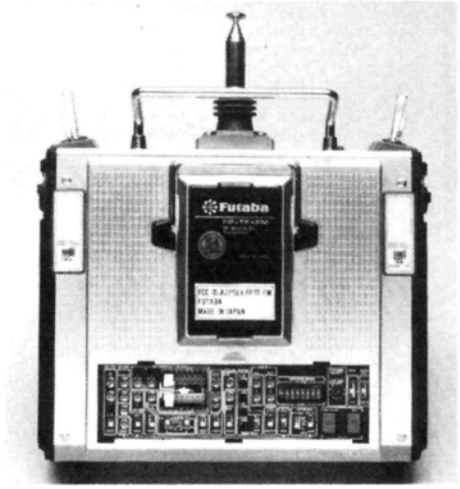
The IMP Rearwin powered by air, gas, or rubber.

Control Tower

by CHARLIE KENNEY

THIS MONTH I have another very popular Futaba* radio to review, the two-stick FP-8SGAP PCM Digital Proportional Radio Control System. This particular two-stick radio has been very popular with both competition and serious sport fliers since its introduction about two years ago. Again I have to try and fit a very sophisticated radio description into the limited space of a column, so here goes with some of the highlights.

The Futaba FP-8SGAP I received operated on 72.870 (Channel 54) with flag code green and yellow. The system consisted of the FP-T8SGAP transmitter with frequency module and Ni-Cd battery pack, FP-R11GP receiver, four FP-S130 servos, SWH-5 switch harness, NR-4J airborne Ni-Cd battery, and many



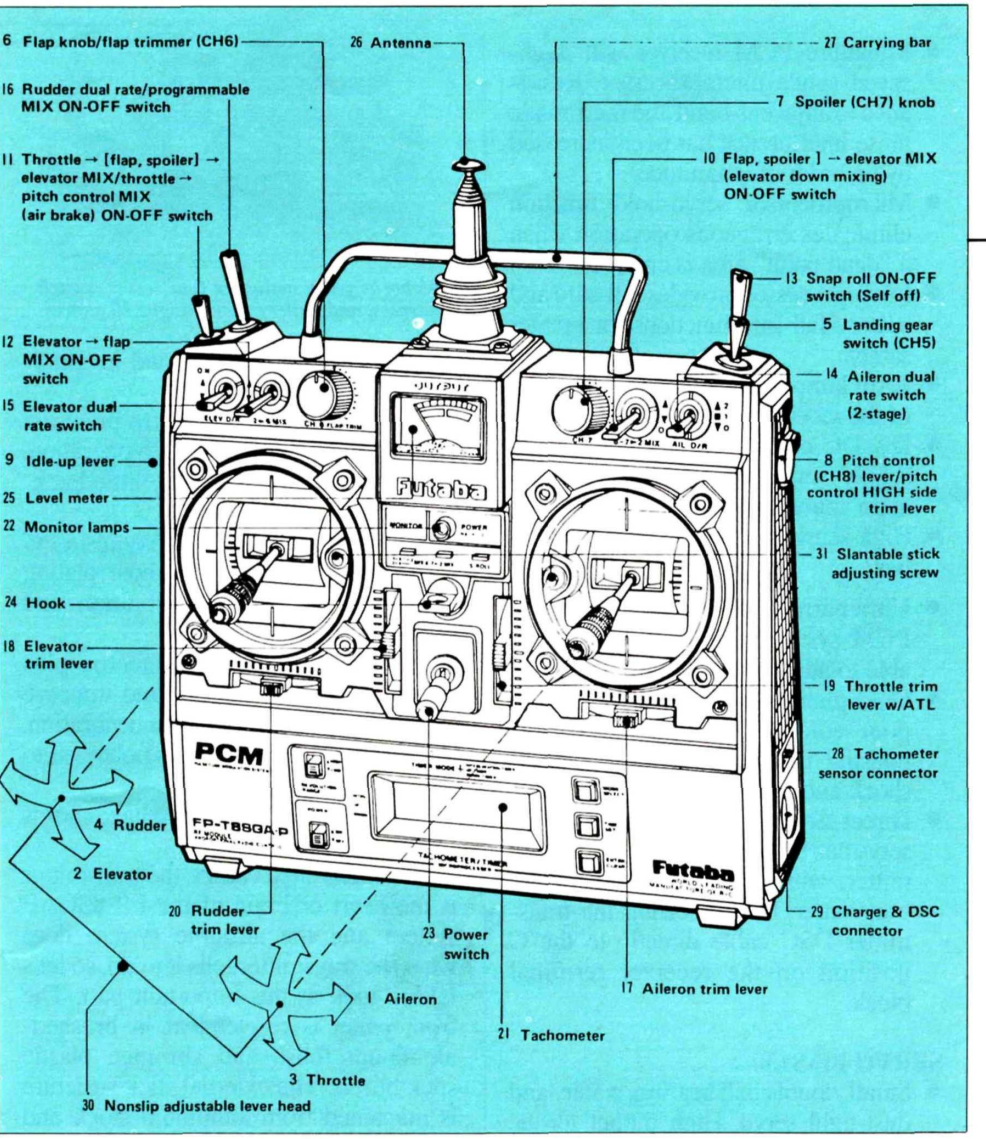
Transmitter rear. Note frequency module at top center and adjustment panel below.

accessories. These included an FBC-8B dual battery charger, Y-configuration landing gear adaptor cable, direct servo control cord (no transmitter radiation), charging adaptor cord, servo trays, frequency flag, spare horns (three per servo), panel adjustment screw driver, and servo-mounting hardware. Let's take a look at some of the FP-8SGAP features.

Business end of the FP-T8SGAP transmitter. Note tachometer/timer digital display at the transmitter bottom.

TRANSMITTER FP-T8SGAP

- RF module system. The frequency module can be changed easily.
- DSC (Direct Servo Controller) allows operation of the servos without turning on the transmitter. Operation is possible by using the special cord supplied.
- Servo-reversing switches on all channels.
- Dual-rate or non-linear VTR (variable trace ratio) aileron, elevator, and rudder. Two-stage dual rate on aileron.
- Rudder auto dual rate. Rudder dual rate is turned On and Off automatically with operation of the throttle stick.
- Newly designed open gimbal sticks which can be slanted to provide maximum operational feel. Stick angle and spring tension can be adjusted.
- Non-slip adjustable lever heads. The stick lengths can be adjusted by turning the knob head.
- New throttle-pitch control mixing for variable-pitch propeller, which maximizes engine power and propeller efficiency.
- Mutual mixing function allows aileron plus elevator, aileron plus flaps, and aileron plus rudder mixing and aileron differential operation.
- Elevator flap mixing is especially advantageous in circle aerobatics.

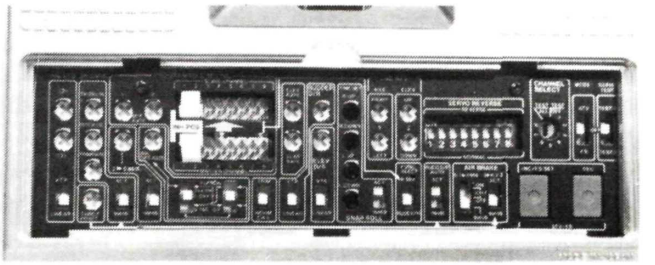


- Flap/spoiler-elevator mixing allows control of the aircraft attitude while using the air brake (flap, spoiler).
- Throttle-pitch, flap/spoiler-elevator mixing allows enhancement of the air braking effect by throttle stick operation when diving and landing.
- Programmable mixing function permits mixing with the desired channel.
- Four-function snap roll switch.
- Idle-up lever, the engine idling speed can be independently adjusted during throttle-prop pitch control mixing.
- Pitch control lever. High-side pitch of variable-pitch propeller can be adjusted during throttle pitch control mixing.
- New ATV (Adjustable Travel Volume) on all channels allows independent adjustment of servo left-right up-and-down throw.
- Second ATV. Besides new push-button ATV on aileron and elevator,

TRANSMITTER FP-T8SAP
Operating System: Two-stick, 8 channels for F3A pattern
Transmitting Frequency: 53 MHz bands, 72/75 MHz bands
Modulation: PCM, FM
Power Requirement: 9.6V 8/500-mAh internal Ni-Cd battery
Current Drain: 250 mA
Size: 7.5x2.5x6.25 inches
Weight: 2 pounds, 13 ounces

RECEIVER FP-R118GP
Receiving Frequency: 53 MHz bands, 72/75 MHz bands
Intermediate Frequency: 455 kHz
Power Requirement: 4.8V Ni-Cd battery (shared with servo)
Current Drain: 42 mA at 4.8V DC
Dimensions: 2.23x1.65x0.94 inches
Weight: 1.85 ounces
Receiving Range: 500 m on the ground, 1,000 m in the air

SERVO FP-S130
Control System: +pulse width control, 1520 uS.N
Operating Angle: One side 45° or greater (including trim)
Power Requirement: 4.8V (shared with receiver)
Current Drain: 5 mA (at idle)
Output Torque: 55.6 ounce-inches



Closeup of trimmer panel. Note eight channel-reversing switches at upper right.

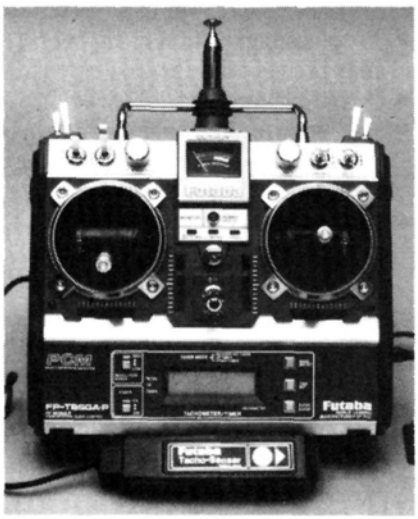
Operating Speed: 0.24 sec./60°
Dimensions: 1.52x0.77x1.36 inches
Weight: 1.47 ounces

BATTERY CHARGER FBC-8B(2)
Input Voltage: 120V AC, 50/60 Hz
Output: Transmitter side 9.6V/45 mA; receiver side 4.8V/45 mA

RECEIVER SERVO Ni-Cd BATTERY NR-4J
Voltage: 4.8V, 4/500 mAh
Dimensions: 2.01x2.28x0.59 inches
Weight: 3.35 ounces

conventional trimmer ATV is also installed.

- Monitor lamp comes on when throttle-flap, flap-elevator mixing or throttle-pitch control mixing and flap-elevator mixing and snap roll are set and goes out when they are in use.
- Fail-safe switch (function Off switch) is provided for each function so that only the desired functions need be turned on.
- Throttle ATL (Adjustable Throttle Limiter) makes throttle linkage adjustment simple and positive.
- Two servo test functions. A slow sweep to check neutral characteristic, trackability cycle to test servo operation.



Transmitter showing hand-held tach sensor which plugs into right side of transmitter.

- Tachometer/timer with built-in tachometer, time-up timer and count-down timer, integrating timers and battery alarm functions.
- Built-in power error back-up circuit. When the internal Ni-Cd battery approaches the fully discharged state, an LED flashes to indicate that the preset memories are gone. Battery must be charged then and all memory functions set again.
- Transmitter employs quality extruded aluminum case. Sophisticated transmitter design makes for comfortable handling.
- Neck strap is supplied as a standard accessory.

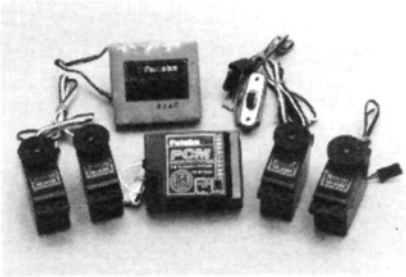
RECEIVER FP-R118GP

- The FP-R118GP is a miniature PCM receiver of the very highest reliability. It incorporates the latest state-of-the-art advances.
- Miniature PCM receiver with high-speed single microprocessor. Resistance to adjacent-band and man-made noise interference has been increased by an order of magnitude.
- Microprocessor servo-hold function eliminates erroneous operation when a "dead point" area is entered.
- Microprocessor provides fail-safe and battery-fail-safe functions for greater safety.
- Error lamp display indicates checking of the receiver is in order.
- DC/DC converter in receiver power supply improves low-voltage operation characteristics.
- High-sensitivity design with RF amplifier.
- Ultra narrow-band ceramic filter and PCM system are virtually invulnerable to adjacent-band interference.
- Gold-plated connector pins eliminate poor contact. Polarized connector housing improves reliability against shock and vibration.
- Direct Servo Control circuit. Each servo can be controlled from the transmitter, without ever turning on the transmitter, by connecting the transmitter DSC cable directly to the C position on the receiver terminal block.

SERVO FP-S130

- Small, double ball bearing, water- and dust-tight servo. High output torque 55.6 ounce-inches .24 sec./60°.
- New indirect-drive potentiometer improves vibration and shock resistance and neutral precision.
- Futaba low-power custom IC provides high starting torque, narrow dead-band and excellent trackability.
- Fiberglass-reinforced PBT (polybutylene terephthalate) molded servo case is mechanically strong and invulnerable to glow fuel.
- Strong polyacetal resin ultra-precision servo gear features smooth operation, positive neutral, and very little backlash.
- Fiberglass-reinforced epoxy resin PC board with through-the-hole plating improves servo amp vibration and shock resistance.
- Thick gold-plated connector pins ensure positive contact and improve reliability against shock and vibration. The connector housing is polarized to prevent reverse insertion.
- Six special adjustable splined horns are available.

Compact FP-R118GP receiver. Note fail-safe hold switch and error light.



Airborne pack, including four servos, switch harness, and battery pack, weighs 10 ounces.

As I mentioned earlier, the transmitter is the heart or brain of the FP-8SGAP system and the airborne system does what the transmitter tells it to do, so let's take a look at this important part. The front panel is resplendent in brushed-aluminum finish and chromed plastic stick bezels. The external stick structure is machined from aluminum stock and uses open gimbal construction.

Let's start with the top controls on the FP-T8SGAP transmitter. To the left rear we have the rudder dual-rate two-position switch, On is toward the front, Off is to the rear. In front of that is the throttle-pitch, flap-elevator mixing switch, next is the carrying handle, and in the center in front of the handle is a 10-element telescoping whip antenna measuring 42 inches long. To the right of the handle on the top is a snap roll switch to the rear, where On is toward the transmitter front and Off to the rear. In front of the snap roll control is the landing gear switch.

This is a good time to identify channel numbers: aileron is No. 1, elevator No. 2, throttle No. 3, rudder No. 4, landing gear No. 5, flaps No. 6, spoilers No. 7, and prop pitch No. 8. Note that although only four servos are provided with the FP-8SGAP, the set is capable of operating eight servos.

(Continued on page 72)

Watch Out!

Basics of Radio Control

by RANDY RANDOLPH

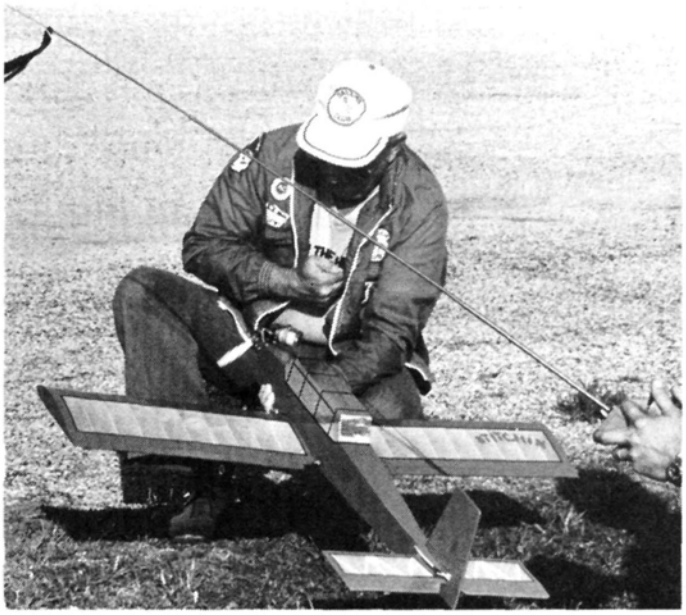
A GREAT DEAL of the information contained in the following is based on an excerpt from an issue of the Dallas R/C Club newsletter. Although not mentioned in the masthead, John Gill is the compiler of things interesting and important for that journal.

The piece listed the ten most common reasons for the "I ain't got it" cry of the Sunday flier. His list, counted down in ascending order, and ways to "head them off at the pass," follows:

10. *An oil-contaminated receiver switch* causes about 3% of failures. The answer, of course, is to keep oil away from the switch. Internally mounted switches which are activated from the side of the airplane away from the exhaust stack are best. Externally mounted switches *must* be on the non-exhaust side and higher, rather than lower, on the fuselage.

9. *A broken wire to servo or antenna* also causes about 3% of failures. This is a question of simple inspection. Before every flying session part of the pre-flight inspection should include all wiring and connectors. That broken wire could be as simple as the failure to connect the aileron servo to the receiver! Check all controls before launch.

8. *A receiver battery with an open cell* causes 3% of failures as well. This one is more difficult to discover in advance, because the voltage reading can be correct one minute and zero the next. Vibration and heat are the killers of batteries, protect them from both! Replacing battery packs at the end of the season is very inexpensive insurance as well.



The cause of most model problems is the pilot. Indeed, flying errors are responsible for 30% of aircraft destruction and most of the other 70% probably can be avoided by careful pilot checking.

7. *A bad or poor connection in the receiver switch* causes 4% of failures. This is related to No. 10, but can be brought about by continued vibration. In the past switches from one manufacturer were notorious for this failure. Good-quality switches with positive On and Off action which are wired in a redundant fashion should remain safe for several seasons.

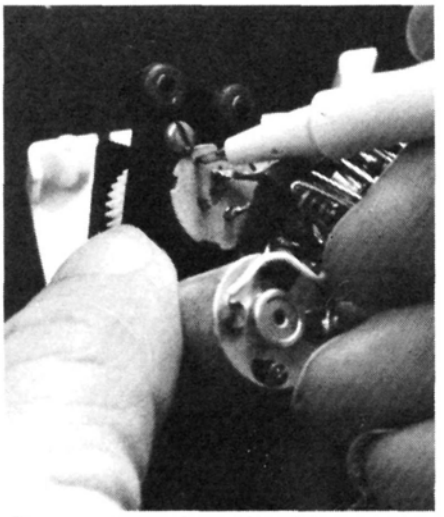
6. *A broken wire in or near the battery pack* also is in the 4% range of failures. Once more a question of inspection. Moving the battery pack while a voltmeter is attached should signal this problem at once. Check for a flicker in the

battery voltage while the engine is running some time during each flying session.

5. *A worn or dirty servo motor* is another 4% problem. Not only the motor, but the gear train as well gives problems in this area. When the action of the control surfaces is slower or control response in the air seems different, the servos should be checked at once. Servos do all of the work on board the airplane, replace them when they become tired!

4. *A worn or dirty servo pot* causes nearly 5% of all failures. The pot, or potentiometer, in a servo is like a volume control on a radio except it follows the output arm and tells the electronics when the arm is in the place it was told to go. Dirty or worn pots cause jerkey and erratic movement of the servo. Worse yet, they cause radio noise that can make all the servos wiggle. Connect the servos one at a time to find the one at fault. When the culprit is found, have it serviced.

3. *Low transmitter voltage from the battery pack* causes a big 16% of failures. There's really no excuse for this one. Most transmitters have volt, or output, meters right on the front in plain view that tell you when this is about to happen. Two hours of average flight time is about all that can be expected from a well-charged pack, that's two hours *maximum* and a *well-charged* pack.



The pen points to the outside of the servo pot. Dirty pots can generate radio noise.

Servo pot interior which should be cleaned with a soft brush and a solvent, usually alcohol.

2. *Low receiver voltage from a battery pack* destroys 25% of our planes! This is related to No. 3, but is not as easy to guard against because the receiver pack doesn't have a meter to tell us when things have gone too far. Servos require most of the current from the battery so flights with a lot of control input drain the pack more quickly than those in which the airplane flies itself most of the time. For that reason it is difficult to judge just how long a receiver pack will function. One way to avoid this type of failure is not to make that "one more flight"!

1. *Pilot error* is responsible for 30% of our destruction....

Quotes Mr. Gill, "Obviously pilot error is the number one culprit in the destruction of our aircraft. Now consider that along with the 30% 'dumb thumb' statistic we should add the numbers from 2 through 10 as easily precedented by builder/pilot, the blame rate goes beyond 90%. That's cause for pause, isn't it?

"Seriously, these numbers are pretty accurate. So if you will try to do good maintenance and fly with reasonable caution, it's likely you'll eliminate over 90% of your accident exposure. That translates to one possible crash in each thousand flights."

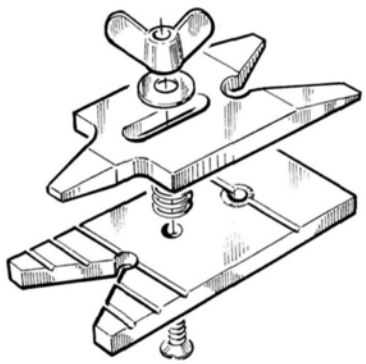
Well said, John....

Randy Randolph, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897. ■

Hints & Kinks

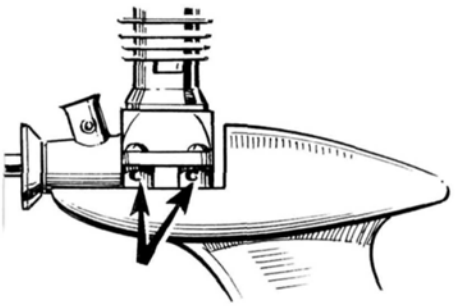
by JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News,** 632 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.



RAF fitters were extremely skilled and all had one of these in their tool kits—as I did. This modeler still has his and breaks it down for your examination. Make from steel, aluminum, or even wood, about 3/16-inch thick. Light spring is useful but not a necessity. Ideal for holding small parts while filing, drilling, etc., this Fitter's Finger Plate is roughly 2x3 inches and can be hand-held or screwed to a bench edge. Slots hold tube, wire, etc.

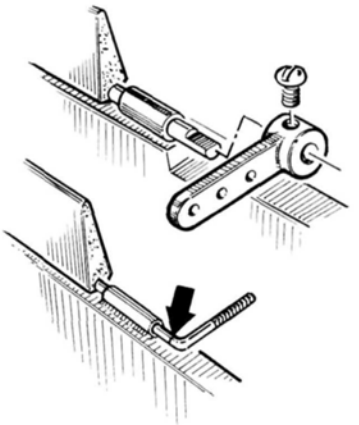
Eric Marsden, Horndean, Hants., England



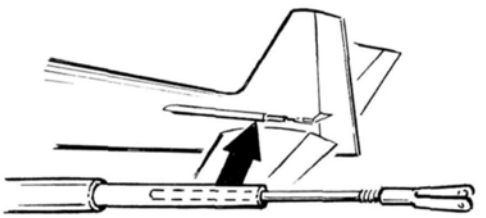
Needing to raise the thrust line to provide greater propeller clearance, instead of resorting to stacks of washers this modeler made use of thick tubular spacers in the form of readily available wheel collars in conjunction with longer engine bolts. *Juan Rablo Movarec, Santiago, Chile*

Collect discarded cigar tubes—filled with lead and marked as shown they are ideal ballast slugs for sailplanes. Some glider guiders provide loops to allow easy removal with a long wire hook, so the loops are shown here.

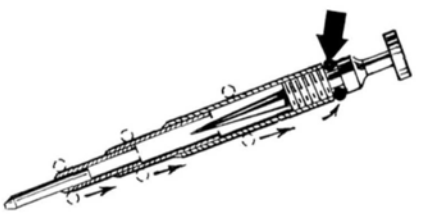
John Richey, North Bend, Nebraska



This builder had a wing left over from a defunct high-wing model and decided to use it on a replacement low-wing plane—but then the aileron horns were on the wrong side of the wing. Here's the solution. Cut the torque rod at the arrow, grind flats on the wire, then use a pair of nose-gear steering arms. Use of Loctite on the setscrews is highly recommended. *Walter Allen, Flora, Indiana*



Some model designs allow an excess of unsupported nyrod—a potential flutter situation. To give additional stiffness it is suggested that a wire threaded pushrod be inserted into the inner nyrod the wrong way round, screwing a portion of the thread into the nyrod before adding the clevis. *James Cassell, Niceville, Florida*



This contributor rightfully says that O-rings on needle valves are critical to proper mixture setting, and during replacement they can easily be damaged. He uses an old antenna, well lubricated and slipped over the needle threads. The ring is carefully worked up over the increasing diameters until it drops neatly into the ring groove, undamaged.

Stephen Horvath, Sulphur Springs, Texas

Construction

PEASHOOTER

A sport plane with simple construction and scale-like appearanc

by HENRY HAFFKE

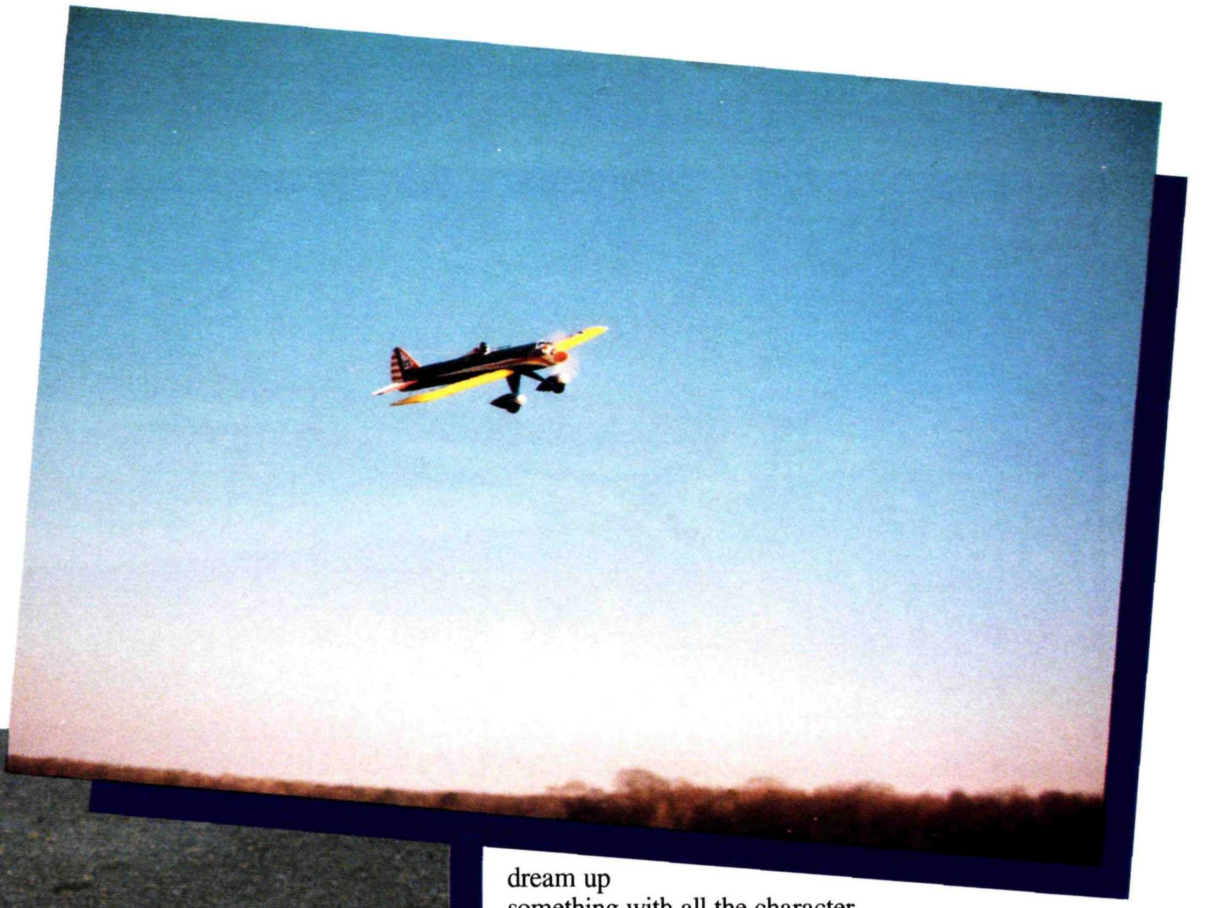
I BUILD practically nothing but scale models of the classic aircraft of the Golden Era. The great aircraft of this period have always fascinated me, as I'm sure they have many of you.

Our club fun-fly events were coming up and I had nothing suitable to fly for the events. A different kind of model was needed for this type of flying. I couldn't just build a boxy-looking model, however, even if it were just for sport flying. It had to look sporty, but it still had to be very simple and relatively quick to build.

Type: *Sport*
Wingspan: *56 inches*
Power: *.40 2-cycle, .46-.48 4-cycle*
Weight: *4 to 5 pounds*
Channels: *4*

I sat down at my drafting board and started to sketch. The results of these efforts produced a sporty-looking shape that was very simple to put together. I envisioned what it would look like when I finished, and I got to my favorite part of the project, putting on the colors and the finishing touches.

While I was thinking of how to finish it, I noticed a photo on my wall, one of my all-time-favorite golden-era aircraft: a beautiful flight shot of the Boeing P-26A with its red, white, and blue fuselage, yellow wings (with the military stars on the



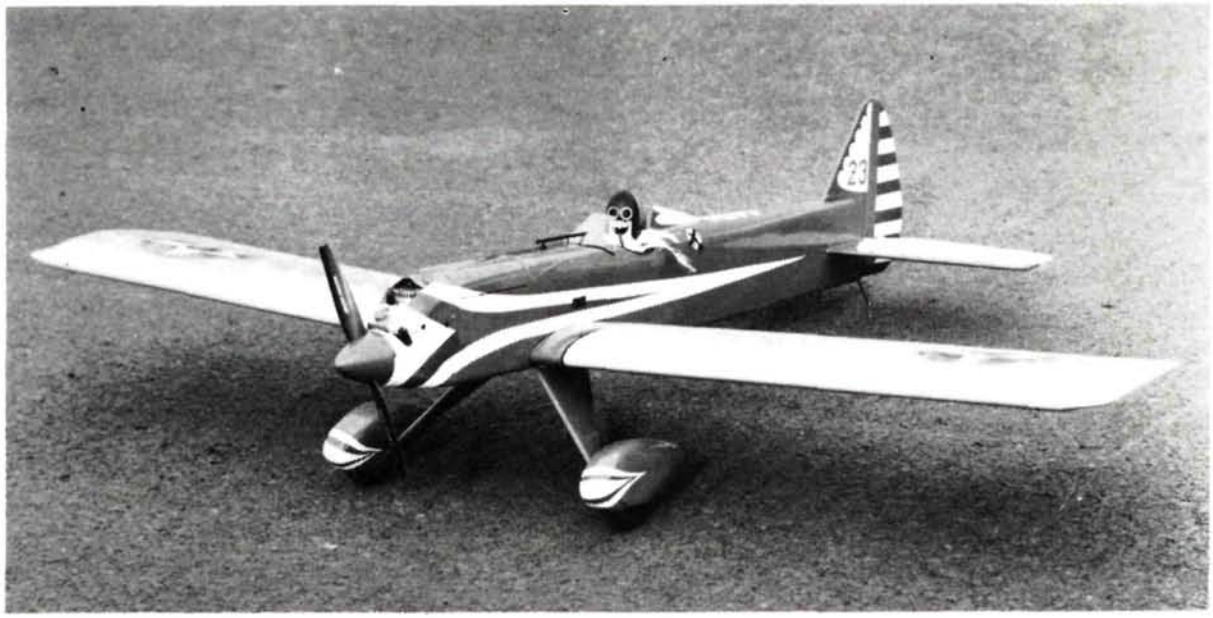
wings) and red, white, and blue stripes on the white tail surfaces along with red scalloped leading edges. I studied the color scheme and envisioned it on my new project. I noticed the conspicuous gun sight protruding from the square-framed windshield and thought, yes, I'll include this too...a pilot in the cockpit...with a pea shooter to really finish it off! Thus, the Peashooter was born.

I get pretty excited over the prospect of a design and when I dream up something with all the character and charm of the Peashooter, modesty aside, I really get charged up. The balsa chips started to fly, and after a short time, I had the parts cut out to build the model. Everything was simple in shape and it didn't take long to prepare this home-grown kit.

CONSTRUCTION. Cut the sides from 1/8-inch balsa. The outline for the sides is shown by little arrows around its edges. Mark the notches that are cut-out where the three bulkheads are located, and cut these out. This makes the assembly of the fuselage foolproof. Cut out the firewall of 3/16-inch ply; 1/4-inch can be used if you prefer. The important thing in starting the fuselage structure is to get it started square. Lay one side down flat on your work area and epoxy the firewall in place after drilling all holes for engine mounting, throttle rod, and fuel lines. Use a square to make sure the firewall stays perfectly straight while the epoxy sets. Then add F-2 and F-3 (they're identical) in the same way, using the square to keep them straight.

When this has set up, epoxy the second side on top of the structure and make sure the tail end is lined up perfectly with the first side. It's a good idea to clamp the tail end together while doing this to make certain that everything is kept straight. When everything is cured, the remaining fuselage bulkhead, F-4, can be added. The ply fuselage doublers are added between F-2 and F-3. Referring to the fuselage drawings, prepare the 1/8x1/4-inch rear fuselage stiffeners and glue them in place. Finally, the 3/16-inch-square stringers can be glued into the notches in the bulkheads from F-2 to the rear. Install the triangle-shaped firewall braces and the basic fuselage is finished.

For the tail surfaces, join the elevator halves with a length of 1/4-inch bass or spruce and allow to dry. Round the edges of the other tail surface parts, but *leave the bottom and front of the fin part un-rounded.*

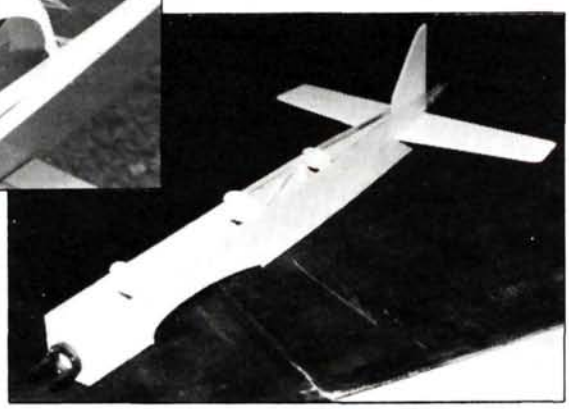


Round the edges of the elevator when the joined parts have set up. Mark a line on the trailing edge of the fin 1⅝ inch up from the bottom and make a cut in this line deep enough to cut away the balsa below it on a bevel enough to allow the tail of the fuselage sides to come together when the fin is assembled between them. Mark the center of the stabilizer and glue the fin on the center line, keeping it square while the glue sets. Slide the fin, stab assembly into the slot in the rear of the fuselage and glue into place. Glue the fuse sides together below the stab and against the fin above it.

It will be necessary to shave the ends of the fuselage stiffening members to allow the proper fit as the fuselage sides come together. Glue the tailskid plate to the bottom of the fuselage sides at the rear and install the tail skid with epoxy. Hinge the elevators to the stab. Cut a clearance notch in the rudder to clear the elevator joiner and hinge the rudder to the fin and rear of the fuselage.

It's a good time to install the radio system now before closing in the back of the fuselage top and bottom. The prototype used a Futaba* radio with S-28

(Continued on page 96)

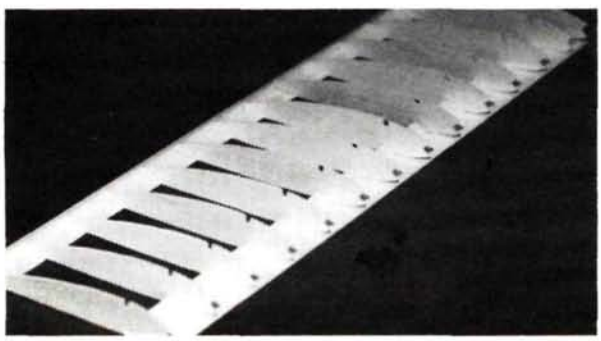


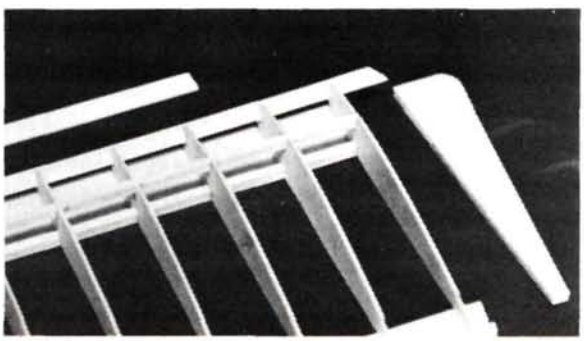
Above: The Black Baron pilots the Peashooter to aeronautical glory. Right: The basic fuselage structure before top planking has been added.

Order the Full-Size Plan!

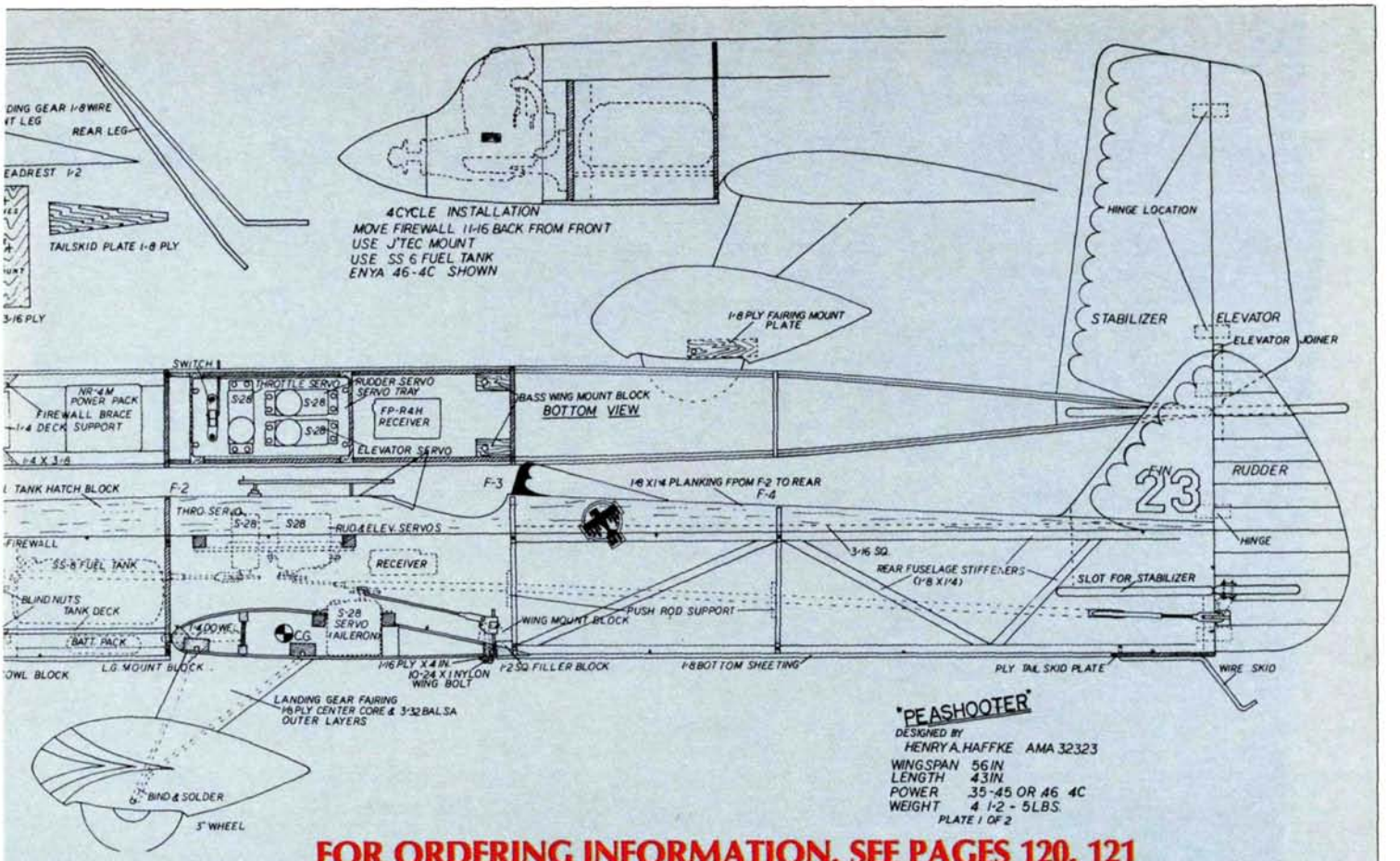
#8871 PEASHOOTER $12.50

A .40 to .45 size low-wing sport trainer for either two- or four-cycle engines. Outstanding scale-like appearance sets this design apart from other sport planes. Span is 56 inches, weight is 4 to 5 pounds, and 4 channels are required. Two full-size plan sheets.

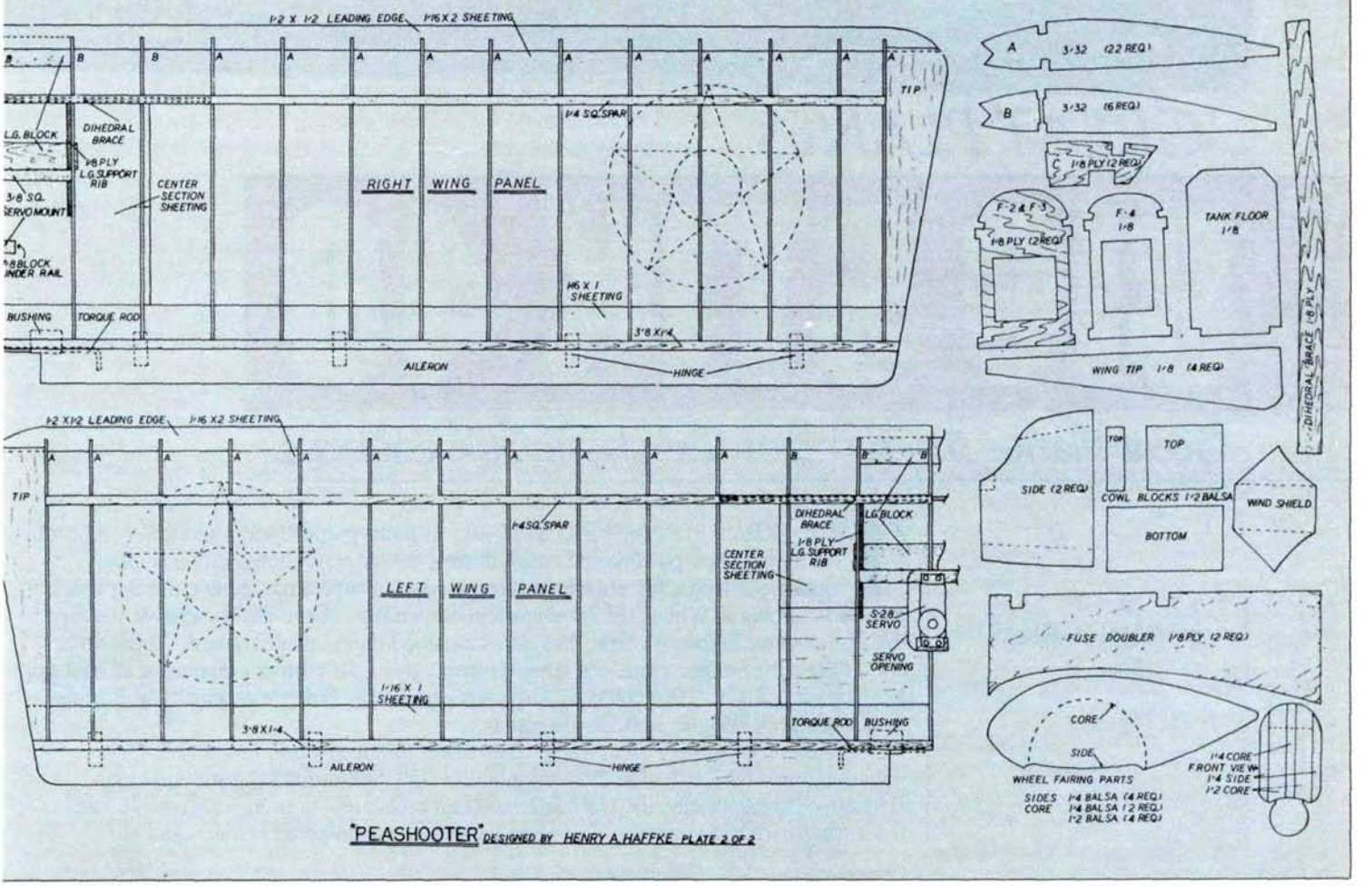




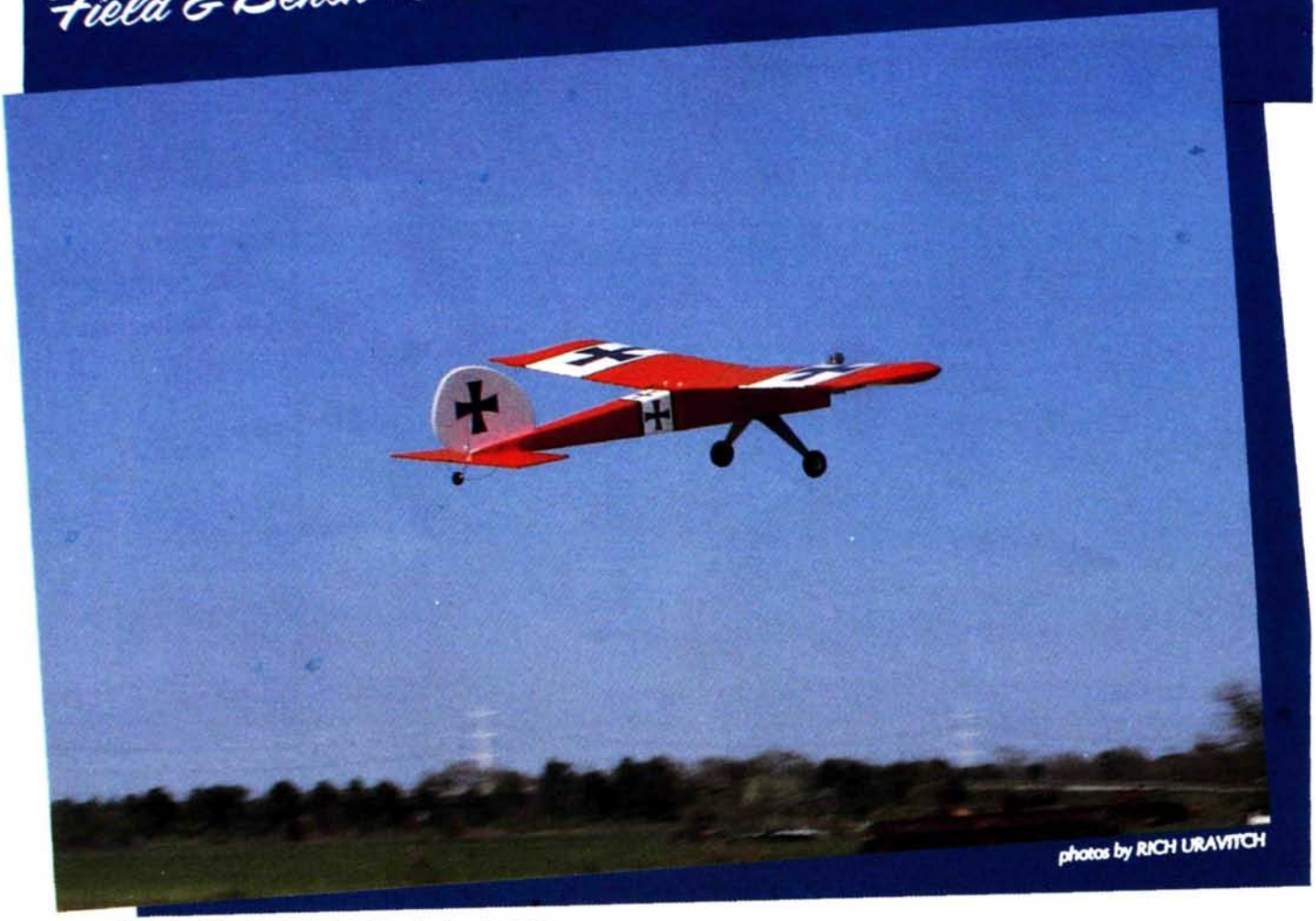
Far left: Basic wing structure utilizes lightweight D-tube construction. Left: Wing tip is a simple sheet affair.



FOR ORDERING INFORMATION, SEE PAGES 120, 121



"PEASHOOTER" DESIGNED BY HENRY A. HAFFKE PLATE 2 OF 2



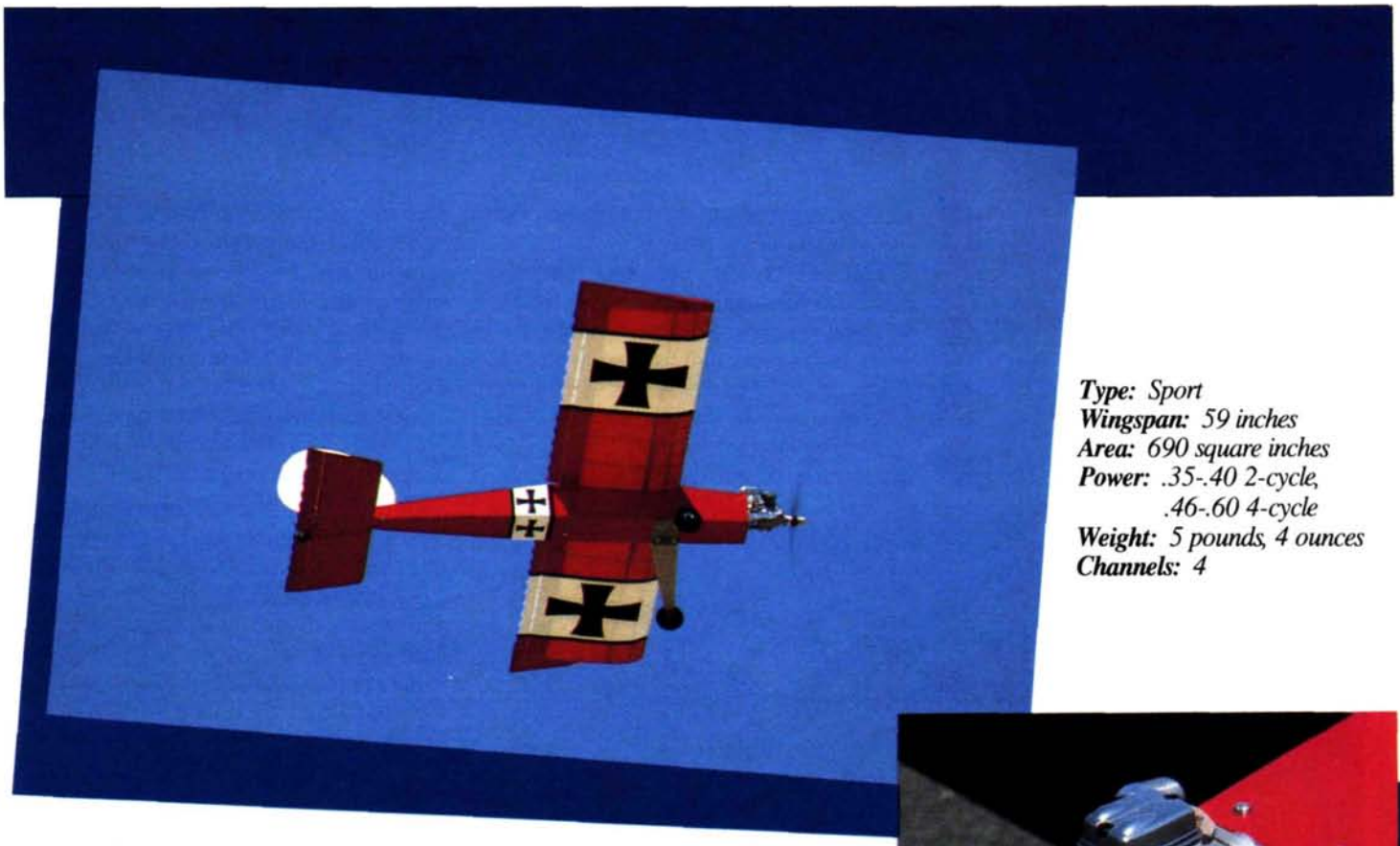
GREAT PLANES BIG STIK 40

Great Planes modernizes the classic Stik concept.

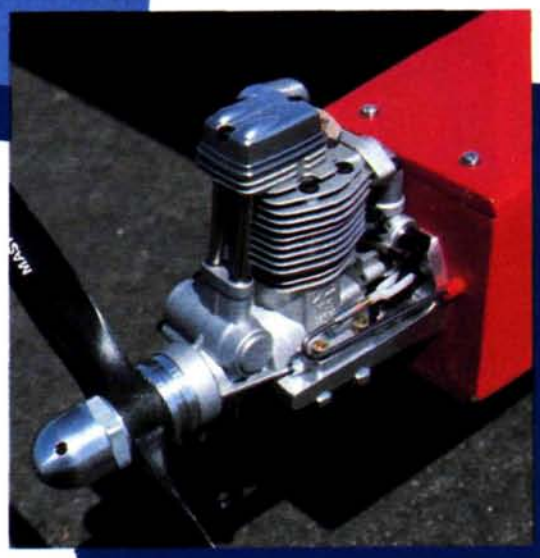
by RON FARKAS

THE GREAT PLANES* BIG STIK 40 is a multi-purpose sport and fun fly aircraft. With moderate power and control throws, this aircraft configuration is quite docile, yet with a big engine and lots of control surface movement, the Big Stik is also very aerobatic. While "stik" designs aren't intended to have all the positive stability that the absolute beginner needs, they do make good intermediate trainers. At the other end of the performance scale, one could probably use it for pattern practice, or at least to keep up his skills between contests. Airplanes like the Big Stik are especially well suited to weekend hot-dogging and fun-fly events.

The credit for this very broad range goes to the famous pattern flier and R/C manufacturer Phil Kraft, who first designed the Ugly Stik around twenty years ago. Because of its popularity, the Ugly Stik has been replicated in every conceivable size from wingspans of two feet to over eight feet. Many manufacturers have used this

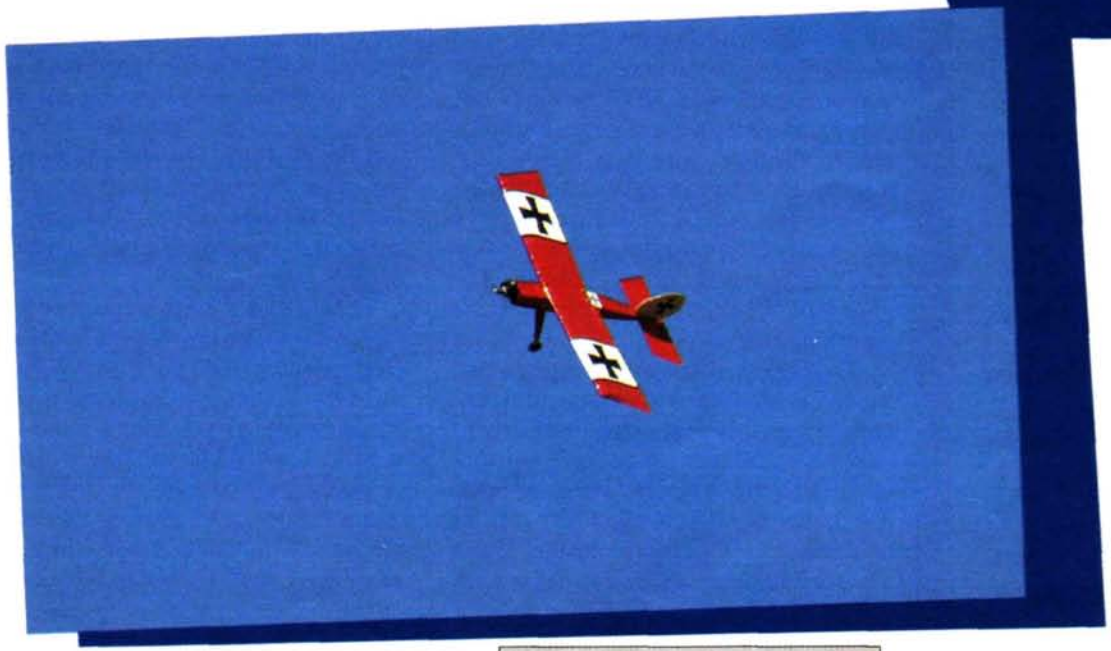


Type: *Sport*
Wingspan: *59 inches*
Area: *690 square inches*
Power: *.35-.40 2-cycle,*
.46-.60 4-cycle
Weight: *5 pounds, 4 ounces*
Channels: *4*



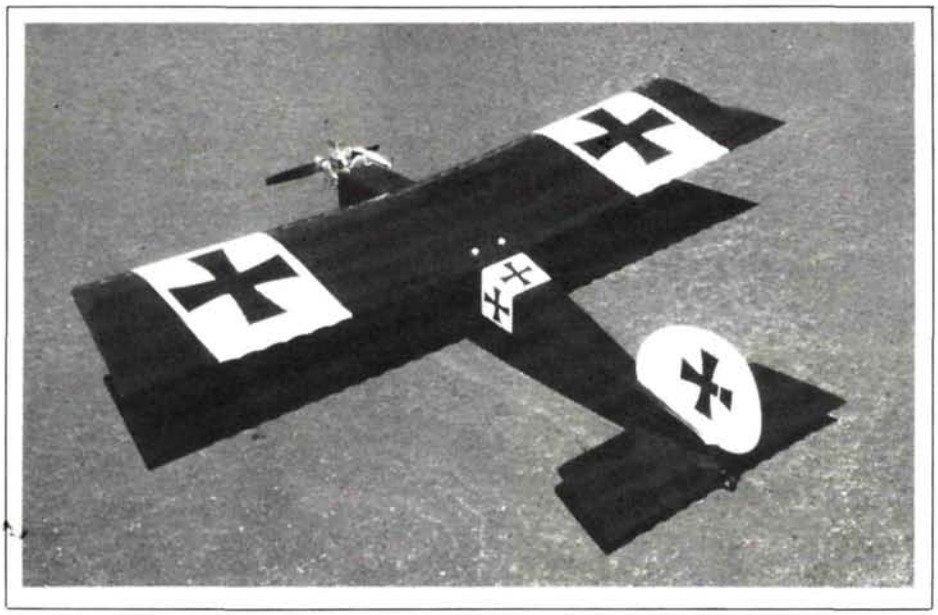
configuration, and the models that bear the most resemblance to the original design generally have the word "stik" in their name. Thus, with the design parameters rather standardized, they all share the same good flying characteristics. Aside from size, the various stik kits differ mostly in the choice of materials and construction techniques, with simplicity as a key goal.

The Great Planes Big Stik series comes in three sizes—20, 40, and 60—that roughly correspond to the intended engine size. The Big Stik 40 has a wingspan of 59 inches and area of 690 square inches. The recommended power is .35 to .46 two-stroke or .46 to .60 four-stroke engines. The model requires a four-channel radio. Both balsa and light plywood materials are used, and the construction techniques feature a combination of built-up wing, sheet tail and slab-sided fuselage with a



modern approach to die-cutting and the use of interlocking parts.

THE KIT is very complete. The ¼-inch balsa fuselage sides, ailerons and tail components are machine-cut, as are several smaller parts, and hardwood blocks. Fuselage doublers, formers and forward bottom sheet are die-cut plywood. The remaining fuselage sheeting is machine-cut ⅛-inch balsa and the spars are bass-



wood, ¼x⅜-inch for the mains and 3/16 inch square for the turbulator spars. Wing leading and trailing edges are notched to lock the ribs into position, and ⅛-inch sheet is used for the trailing edge and center section sheeting. Hardware includes dural main landing gear, both wire nosewheel and tailwheel struts, nylon motor mount, and a large assortment of screws, nuts, clevises and hinges. Pushrods are of the steel wire in a plastic tube variety. Even the fiberglass cloth for the wing section is in the kit. The rolled plans are clearly drawn, with wings on one side and fuselage and tail on the other. The instruction booklet is extremely thorough and well-illustrated.

The builder will find the construction techniques to be quick and simple. There are remarkably few individual parts to assemble, and they really do fit together quite perfectly. With very few exceptions, the balsa wood is well-chosen for its intended use. I've been told that Great Planes does a balsa density check. They pull material for parts cutting and, for even more consistent results, they are now coding the proper density into the computerized bill of materials for each design. I also found that the use of hefty wood sizes made the pieces easier to handle and less prone to breakage. In short, it is an excellent kit with high-quality materials and clean die-cutting. The finished product is a strong airframe of reasonable weight for its size.

CONSTRUCTION. The kit engineering and the assembly process are primarily based on the use of both thin and thick cyanoacrylate glue. My Big Stik 40 was almost entirely built with Carl Goldberg Models* Jet and Super Jet adhesives. Where epoxy is called for (wing joining for example), I have used Hobbypoxy* Formula II. Here is a quick rundown of the major construction steps.

The fuselage sides are prepared by gluing on the plywood doublers and former lockplates. The sides are then trial-fitted with the formers, and held together by rubber bands. Next, the plywood and balsa bottom sheets are slipped into position along with the landing gear block. Once the alignment is verified over the plans, all the joints are glued with thin cyanoacrylate and then reinforced with thick cyanoacrylate and spray accelerator to create glue fillets. A few more steps are required to install the wing-hold-down blocks, forward hatch and part of the top sheet at the tail. The major section of aft top sheet is left off until after pushrod installation. I chose the tail-dragger landing gear arrangement since Great Planes has provided an alternate main gear mounting plate and a steerable tail wheel assembly for this purpose. One small modification that I made was to secure the main gear with 1/4x20 nylon bolts instead of steel screws, allowing it to shear off in a hard landing without pulling out the mounting block.

The fin and stabilizer are to be glued together from two parts each. In my early production kit I did find the aft fin part too soft for my liking, so I replaced it with a harder piece to provide a more solid tailwheel mount. The stabilizer is installed on the fuselage bottom. The fin fits down into a slot in the fuselage top sheet and also rests firmly onto the stabilizer for a nice strong, well-aligned installation.

(Continued on page 112)

PROPELLERS. For most engines, the user has the option of fitting a machine-made wooden propeller, or a molded plastic type. Wood props are generally made of maple or beech. Molded props are mostly made of nylon, glass-reinforced nylon (GRN) or of epoxy resin reinforced with glassfiber, carbon-fiber or polyester fabric material. Each type has certain advantages and disadvantages and the user should be careful to select the type that is best suited to his engine and the purpose to which it is to be put.

The Operation of Four-Stroke Engines

Part II

by PETER CHINN

Nylon

First, it must be stated that props made of plain nylon and other nonreinforced plastic materials are not recommended. These propellers, the first examples of which were seen in the late Forties and early Fifties, are adequate only for the very smallest low-powered two-cycle engines such as the .049 cu in. "Half-A" class. When used on more powerful engines, such material has insufficient tensile strength to withstand the high centrifugal forces generated at normal revolutions and this will result in blades fracturing and being thrown off at high speeds. Since propeller tip speeds may exceed 600 feet per second, or more than 400 mph, it can be readily appreciated that a sharp piece of propeller blade can inflict severe injury on anyone in its path.

To a lesser extent, similar objections can be levelled against glass-reinforced nylon props, particularly those using powdered glass filler rather than glass-fiber filaments. When such props were first introduced, some twenty years after the earlier plain plastic types, they were supposed to be safe, but it was soon demonstrated that they could not be relied upon to absorb the power of many of the newer engines. More recently, however, improved GRN props have been put on the market which appear to be capable of remaining intact at somewhat higher speeds.

O.S. safety prop fastener, left, as supplied with their Gemini, Sirius, and Pegasus engines. With a through-bolt type fastening, right, it is essential to use props with adequate hubs.

In some cases, these more recent GRN props are packaged with specific recommendations listing the largest displacement engines with which each sized prop should be used. *Do not ignore such recommendations.*

Calculating Safe RPM

Also aimed at discouraging users from fitting GRN props to engines that are too powerful for them, the German Graupner company has issued a warning that the maximum propeller tip speed, in the plane of rotation, should not exceed 180 meters per second (i.e. 590 fps) with the Graupner "Super Nylon" range of props.

To aid calculation, Graupner suggests the use of a simple formula which can be expressed as follows:

$$\text{rpm} = \frac{3{,}438}{D}$$

where D = diameter of propeller in meters.

Using this formula, if we take a 12-inch (0.305 meter) diameter prop, its safe operating speed will be seen to be:

$$\frac{3{,}438}{0.305} = 11{,}272 \text{ rpm}$$

Alternatively, the formula can be re-written to show the maximum prop diameter that can safely be used when it is

Fox Prop Reamer is an excellent tool to open prop holes to 1/4-, 5/16-, and 3/8-inch sizes.

desired to match prop size to a given rpm (such as when the user wishes to employ as much as possible of the engine's maximum power output) i.e.

$$D = \frac{3{,}438}{\text{rpm}}$$

In this case, assuming the required operating speed to be 10,000, the maximum allowable prop diameter would be:

$$D = \frac{3{,}438}{10{,}000} = 0.3438 \text{ meters} = 13.5 \text{ in.}$$

If the power of the engine is such that safe rpm are likely to be exceeded for the chosen prop diameter (remember to allow for build-up to higher rpm in flight) the user has a choice of two options: (a) use a propeller of greater pitch or blade area to reduce speed or (b) change to a wood or epoxy propeller.

Epoxy

Epoxy props usually have their reinforcing materials (mostly glassfiber but sometimes carbon fiber) extending from tip to tip and are extremely strong. Being partially hand made, they are more expensive to manufacture and rather costly to buy although, as they are highly resistant to impact damage, as well as to blade shedding, they far outlast all other types of prop. These props are heavier than wooden ones, but that is an advantage with a four-stroke engine where the inertia, or "flywheel effect," of a heavy prop is a worthwhile aid to even running. The main disadvantage with epoxy props is that the range of sizes available is very small at the present time.

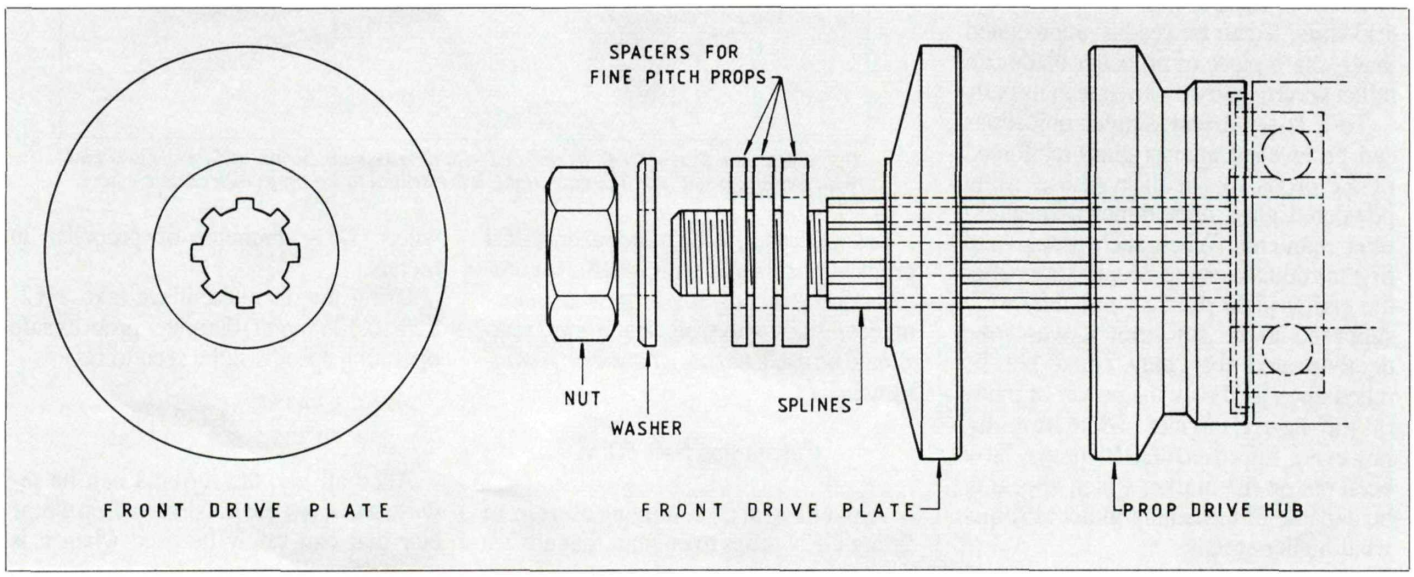
Wood

Wood props offer the most extensive selection of types and sizes and are widely used for the larger displacement engines. They are somewhat less resistant to accidental damage, such as nicked blades or tip damage on takeoff or landing, but have a good tensile strength to resist blade shedding at high revolutions.

A disadvantage of some wood props, when used on certain large displacement four-stroke engines, is the relative weakness of the propeller boss. Four-strokes, in general, are more prone to detonation and all four-strokes (especially single-cylinder examples) suffer from considerable variation in torque delivery through the cycle, both of which can result in the prop slipping, especially if the diameter of the prop driver or the prop boss is small and the frictional contact between the two surfaces is inadequate. Deep serrations in the prop driver face do little to help matters here: if it slips, the serrations will simply gouge material from the back of the prop.

Pinned and Through-Bolt Prop Fixtures

To prevent such movement, some manufacturers have resorted to keying the prop



driver to the propeller itself. This usually takes one of two forms. The simplest is to fix dowels or pins (usually two at 180 degrees to each other) in the face of the prop driver, projecting forward, so that they engage suitably drilled holes in the back of the prop boss. The pins are most commonly pressed-in steel roll pins or screwed-in studs.

The other method is to use full length screws through the front prop retaining washer, through the prop and into the prop driver behind it. Four or six screws, spaced at equal intervals, may be used, the assembly being basically similar to the through-bolt type hub commonly used in the past for fixing wooden propellers to full-sized aircraft. The normal prop nut is, of course, retained for securing the complete assembly to the crankshaft.

These two methods of retaining the prop work satisfactorily only so long as the prop nut is kept tight. It is advisable, in fact, to check the prop nut for tightness every time that the engine is started. Preferably, a self-locking stop-nut or an extra jam nut should be used.

If the nut is not kept tight or the slightest movement develops between the prop and prop driver, the fact that the prop boss has been drilled to accommodate drive pins or through-bolts will prove to be a source of weakness.

Under such conditions, detonation or, alternatively, the severe mean-to-maximum torque fluctuations that occur with a powerful single-cylinder four-stroke engine, can actually cause the prop to split apart, especially if the locating holes through the prop boss are aligned with the grain of the wood. It is worth bearing in mind here that, if two holes are used, they should be positioned so that a pencil line, drawn through their centers, is across the grain of the wood, not parallel to a line connecting the two tips of the prop. If the boss requires four holes, two should be aligned across the boss as just explained.

Prop Slippage

Often overlooked, a further problem arises when the prop does not have a sufficiently large diameter boss to safely accommodate the pins or screws. It has to be admitted that there has been a certain lack of appreciation, by prop manufac-

(Continued on page 108)

DUKE'S MIXTURE

Has your motor ever stopped half way thru a flight? The usual points of suspicion are:

1. *Hole in flopper tube just inside tank.*
2. *Flopper tube fell forward and caught.*
3. *Rear cover came loose.*

Now we find we must add a fourth

4. *A restricted pressure line or too small a hole in the pressure fitting.*

Now as mufflers tend to become quieter and have more back pressure, here is what seems to happen: At wide open throttle the muffler puts quite a bit of pressure on the tank. At partial throttle or idle, the muffler introduces virtually no additional pressure. The carb, of course, is contoured and adjusted to fit this pressure variation. Now — you are flying along full bore with 1/3 tank of fuel, and you pull back to 1/2 throttle. Until the tank pressure bleeds off, an excess of fuel is going to be pushed into the engine — enough in some cases to cause a flame-out. If you are having this type of problem, the fix is easy. Drill out the pressure fitting (1/16 hole seems adequate for 60 size motors with 14 oz. tanks.)

We have now completed our new 45 casting die. If all goes well, we will be shipping new Fox 45 BB RC's by the time this is published. The new 1987 model will feature a larger wrist pin, and a larger crankpin. The wrist pin has been lowered in the piston to improve the side load distribution. A new, slightly shorter rod accommodates these changes. The new motors will be supplied with a die cast spinner and a tilt down muffler. (The tilt down muffler can be exchanged at no charge for a tilt up if you so desire.)

The plan is to produce both a 45 and 50 in this frame — and later this summer, A.B.C. versions of both. Also, our quickie 500 special will be built in this frame.

Our 4 cycle plug card no longer says "4 cycle", but says "Miracle Plug". Although this plug was originally developed for 4 cycle motors, this plug has noticeably superior resistance to flame-outs compared to our well known long R.C. in 2 cycle motors also. Unfortunately, the words "4 cycle" scared off many modelers who would benefit the most. Hence, the name change.

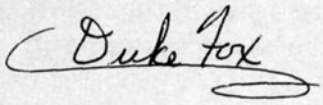
Another important cash benefit from using this plug is the ability to burn lower cost fuel. A drop of 5% in your nitro content will save the price of this plug with the first gallon you use.

In case you don't know how to determine the optimum nitro content for your motor — here is how it is done.

Fill the tank with the fuel to be tested. Start your motor and run it up at full throttle at your take-off mixture setting. After 15 seconds warm up, touch the plug with your battery lead. If the motor slows down, reduce nitro content. If it remains the same, or speeds up a couple hundred RPM, you are at optimum. If it speeds up quite a bit, you need more nitro. After the test, check to see if your plug is still good. If the plug is burned out, re-do the test. Your goal is to use a fuel that speeds up only a trace with additional glow plug heat.

I think that one of the biggest con jobs going is the idea that totally free (no import duties) trade is desirable. If a consumer spends $100.00 for a USA product, about $30 of it finds its way to the government via payroll and material taxes. If he spends $100.00 on an import, vitrually nothing goes to the government. Since the importer has to pay $30.00 less than the domestic manufacturer for the privilege of selling to the American public, he is going to be able to give the greater value. Without this income, the government is going to raise taxes on you know who. I suppose eventually we are supposed to support ourselves by doing each others' wash. For the first time in 20 years, Congress is showing signs of realizing that something is wrong with flooding our country with untaxed imports. Now is the time to make your congressman aware that if imports paid an equal share of the government load, the trade deficit would drop, unemployment will drop, and the government income will increase.

Happy flying,



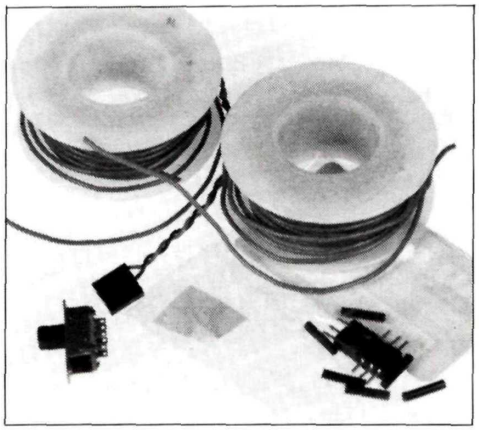
FOX MFG. CO. — 5305 TOWSON AVENUE
FORT SMITH, ARKANSAS 72901
PHONE (501) 646-1656

How To:

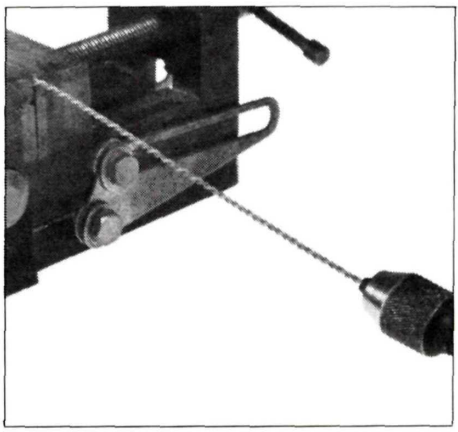
by RANDY RANDOLPH

WIRE A SWITCH

Sometimes it's necessary to replace a switch or make a harness for a new receiver. Whatever the case, the pictures show the way to wire a switch for redundancy in airborne equipment.



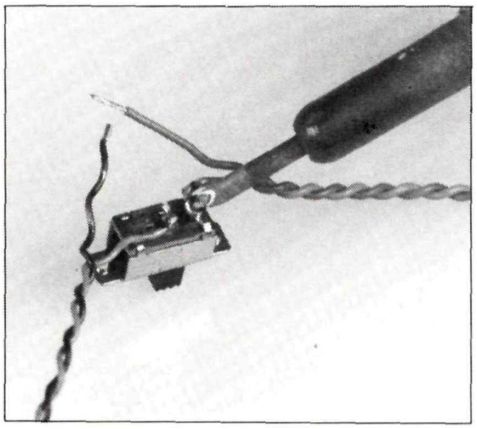
1.



2.

1. The required parts include a double-pole, double-throw switch; red and green stranded wire; connectors (if needed); and heat-shrink tubing. A small-tipped soldering iron and some solder are the necessary tools.

2. Cut two 12-inch lengths of wire and braid them together. An easy way to do this is with a hand drill and a vise. Stretch the wire slightly before twisting.



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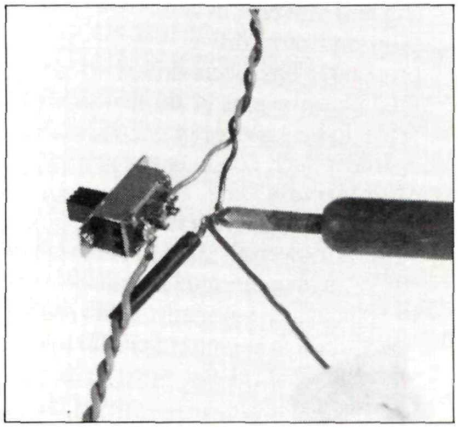
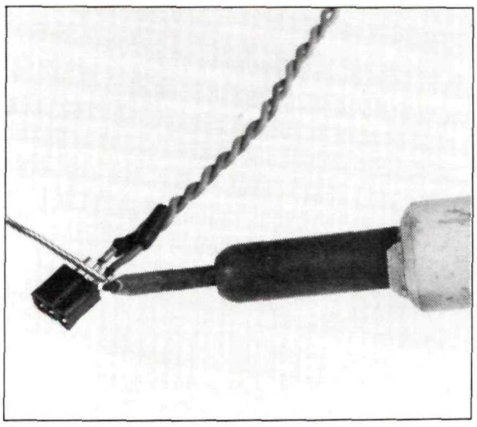


4.

3. Cut the twisted wire in two at the center, then strip ¼ inch of insulation from all four wires. Solder one red wire through **both** center terminals of the switch and the other red wire through **both** terminals on one end.

4. Slip a 1-inch length of heat-shrink tubing over one of the black wires, then solder both black wires together. Slide the tubing over the joint and shrink it in place.



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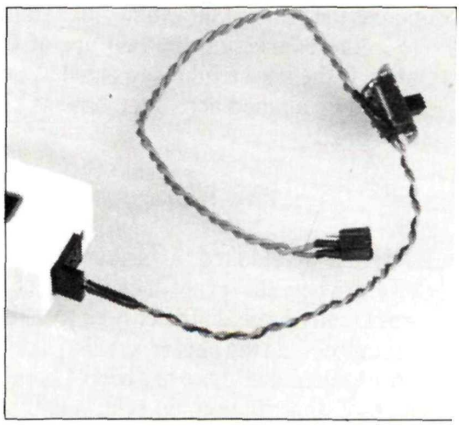


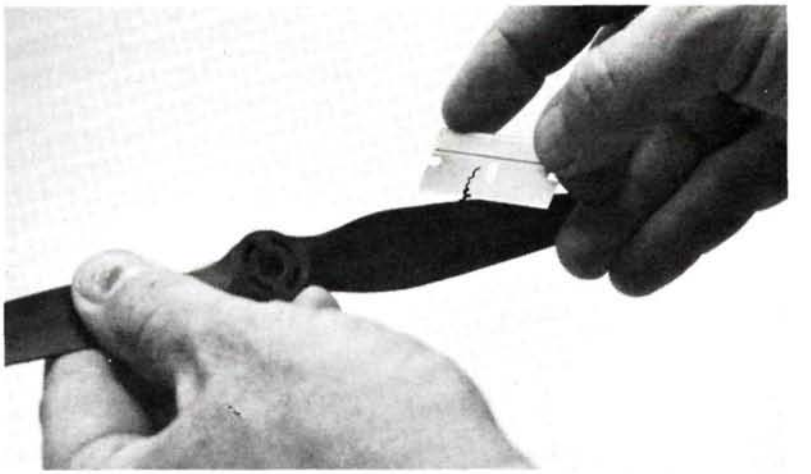
6.

5. Strip ⅛ inch of insulation from both wires at one end of the cable, slip heat-shrink tubing over both, and solder them to the connector. Slip the tubing over the terminals and shrink in place. Be sure to match terminals with mating connector.

6. The finished harness. There is no provision for a charging system in this arrangement, because I prefer to disconnect the battery and connect it directly to the charger.

Plane Facts About Propellers

by JOE WAGNER



A single-edge razor blade makes a good scraper to remove sharp edges from plastic propellers. This should be done to avoid injury.

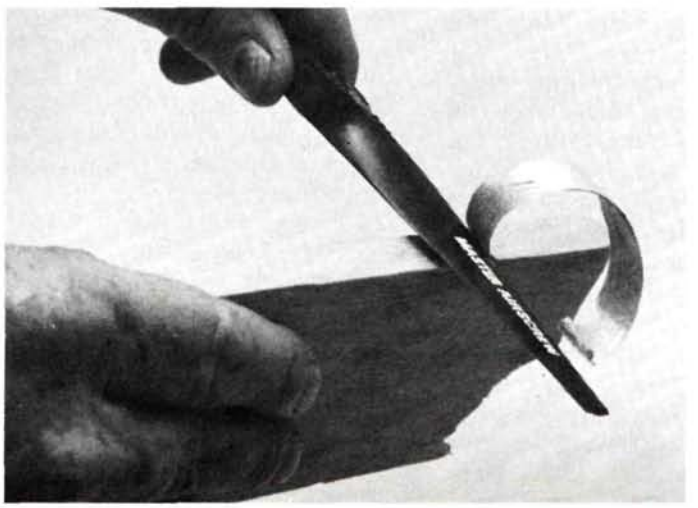
THE PURPOSE of a propeller is to provide thrust for moving a vehicle. They're designed for contact with air, not with people. Yet most injuries that happen when flying model airplanes are due to propellers.

Propellers are commercial products made to sell at a profit. To insure that they will make a profit, propeller manufacturers do all they can to keep production costs low. A few of their cost-cutting measures can be dangerous to us modelers. But by taking a few simple precautions, we can make our props a great deal safer to use.

For example, most plastic props have sharp edges, the result of their molding process. It would be expensive for the manufacturer to remove these razor-like burrs, so the props are marketed just as they come from the mold. Some are so sharp you can carve wood with them! In use, such propellers are more dangerous than most of us realize.

Consider this: power lawnmowers, which are responsible for so many accidents caused by their whirling blades that strict government regulations now control their design, only turn about 3,000 rpm at full throttle. Their cutting blades average about 22 inches in diameter and are fully shielded by a sheet-metal guard to keep anyone from getting hurt.

Compare this with a 10-inch propeller turning 14,000 rpm on the nose of a model airplane. Completely out in the open, it spins half an inch away from our unprotected fingertips when we're adjusting the needle valve. If this prop is a molded plastic one, used just as it came from its maker, it's a lot sharper than the average lawnmower blade. With its tip speed double that of the mower, and 41/2 times as many "cutting strokes" per second, is it any wonder that it frequently hurts people?



The edges of some plastic propellers are as sharp as an X-Acto knife blade.

The best thing to do to a model engine's propeller before putting it in use is to round off all its edges, from hub to tip. A wooden prop's edges can be radiused with sandpaper, but this often doesn't work on nylon props. Nylon tends to fuzz up when sanded. A better way is to scrape with the edge of a sharp blade, or even a piece of broken glass.

Theoretically, sharp edges are supposed to make a prop more efficient. But this only holds true when the propeller is working at its most efficient angle of attack. Even then, the gain is no more than about 4%. At anything other than the optimum attack angle, a rounded leading edge is superior. This particularly applies during acceleration, as in takeoffs and climbouts. Thus, radiusing a prop's edges not only reduces the likelihood of cuts; it usually improves the model's overall performance, too.

Another performance improver is balancing. This, too, makes for safety because out-of-balance propellers are a

major source of vibration, vibration that can lead to radio malfunction, or even structural failure.

There's only one right way to bring a prop into balance: carefully remove material from the heavier blade by sanding or scraping. Avoid all nicks or abrupt changes of contour. Keep the surfaces as smooth as possible at all times, and use one of the commercially available prop balancing devices to check your progress often as you go. While you're at it, balance a couple of spare parts, so you won't be tempted to take a chance on an unbalanced one if you should break the prop you're using to fly with.

Propeller manufacturers tell us never to make any modifications to their products. That warning is supposed to protect them from being sued by some inexperienced modeler who might otherwise notch the hub of his prop to fit a spinner, and then lose an eye when a blade flies off at 16,000 rpm. But I am recommending changes to propellers that increase their safety and prevent failures rather than cause them.

Prop breakage is a serious danger. It can occur from any of several causes, which we must guard against vigilantly. First: any nicks or cracks in a propeller will concentrate stress at the flaw and make blade failure likely. Never use a prop that's nicked or cracked! Shallow marks in the leading edge can usually be scraped or sanded out. But this requires reshaping the opposite blade as well, for symmetry and balance.

Another reason for propeller breakage is hub modification—both intentional and accidental. Some modelers whose props slip on the shafts of their engines drill holes in the hub and install drive pins. This often becomes a bad stress concentrator. The drive pin may very well split the hub. Or, in another attempt to cure slippage, a modeler may tighten the prop nut so hard that it crushes the hub and weakens it severely.

The best way to eliminate prop slippage without harming anything is to epoxy a facing of coarse sandpaper to the inner surfaces of the prop drive washers, and then tighten the nut enough to be secure—but no further.

Wooden props can fail from faulty wood grain. No propeller maker can possibly inspect each individual piece of wood that gets machined into a prop; and some wood has highly irregular grain patterns. Most of these will do no harm, but beware of any prop with crooked grain in or near the hub. Look at both the faces and both edges: if the grain isn't within about 20° of the blade centerline, don't run the prop on an engine.

There are model experts who say that plastic props are good only for paint mixing. It's true that some plastic props can fail most unexpectedly. However, if you understand a few things about their limitations, you can use them quite safely, even on engines as large as .60s.

First, never use plastic props made from anything except nylon or fiberglass. Some older propellers were molded from other plastics which aren't very strong, or that deteriorate when exposed to glow fuel or even bright sunlight. You shouldn't use any plastic props that aren't made from either nylon or fiberglass. They might fly apart without the slightest warning, as has happened to me!

Nylon props—even reinforced nylon—need special precautions, especially in dry climates. You see, nylon contains water as part of its molecular structure. In much the same way that the water that's mixed with sand and portland cement becomes a chemical part of hardened concrete, water is also an integral component of nylon plastic. Unlike concrete, however, nylon can lose some of its water content if it's exposed for a while in a dry environment. That makes it lose some of its strength—perhaps as much as 35%, which means danger!

To prevent this from happening, all you need do is to soak your nylon props overnight in water, or boil them for half an hour. Repeat this once each week or so when the humidity has been continuously under say 50%.

The other reason for plastic prop failure is simply running them too fast. Any propeller will fly apart if spun fast enough. But plastic props are more sensitive than wooden ones to high rpm, especially in hot weather. The accompanying table lists the maximum safe speeds for nylon props of various types and sizes.

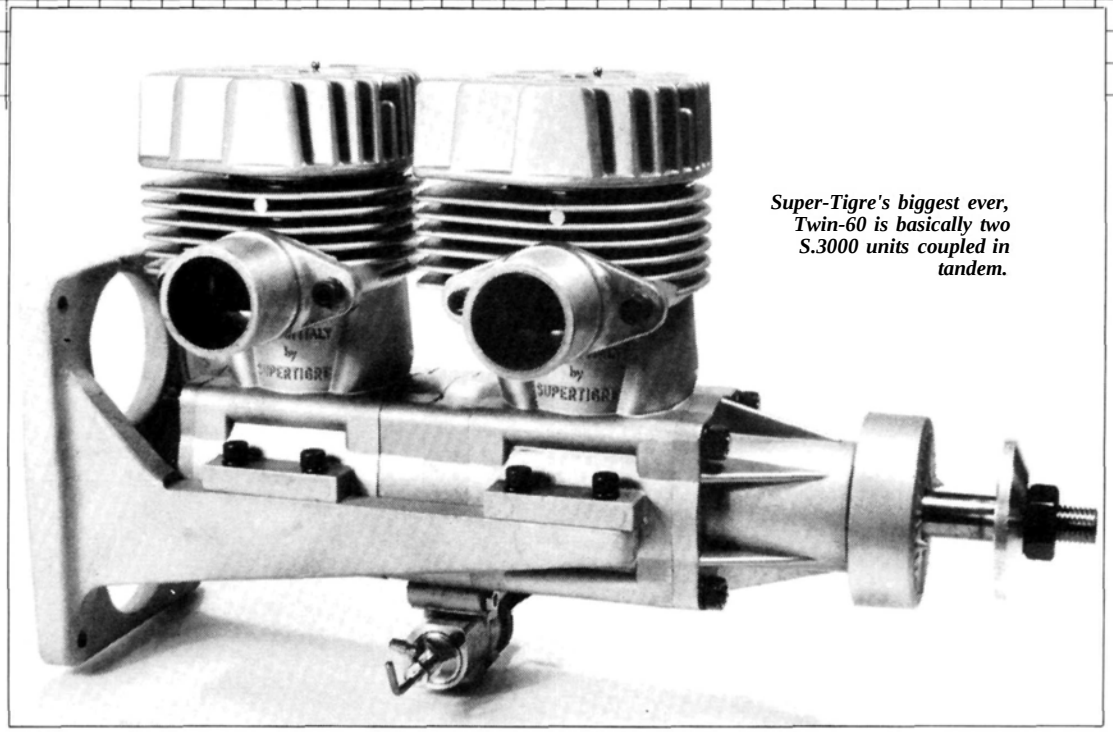
Fiberglass props can safely exceed these limits somewhat. But why take chances on high rpm in the first place? Propeller efficiency is better at slower speeds; lower engine rpm means less irritating high-pitched noise output; and there's far less chance of a blade breaking off from any cause.

One more thing seems worth mentioning here about model airplane propellers: the stiffer they are, the better they work. Flexible props may not break so easily in a rough landing, but they tend to twist when the engine is running fast—and the pitch changes are unfavorable. If you want to get the best performance out of your models, use the stiffest props you can get, hardwood (such as maple) or glass-reinforced plastic. ■

MAXIMUM SAFE RPM FOR NYLON PROPS

PROPELLER DIAMETER	PLAIN NYLON	REINFORCED NYLON (GRAUPNER)	REINFORCED NYLON (MASTER AIRSCREW)
6 IN.	14,400	22,500	25,000
7 IN.	12,600	19,250	21,000
8 IN.	11,250	16,800	18,500
9 IN.	16,800	15,000	16,500
10 IN.	10,000	13,500	15,000
11 IN.	9,100	12,250	13,500
12 IN.	8,500	11,250	12,500

Engine Review Round-Up



Super-Tigre's biggest ever, Twin-60 is basically two S.3000 units coupled in tandem.

Super-Tigre Twin-60

by PETER CHINN

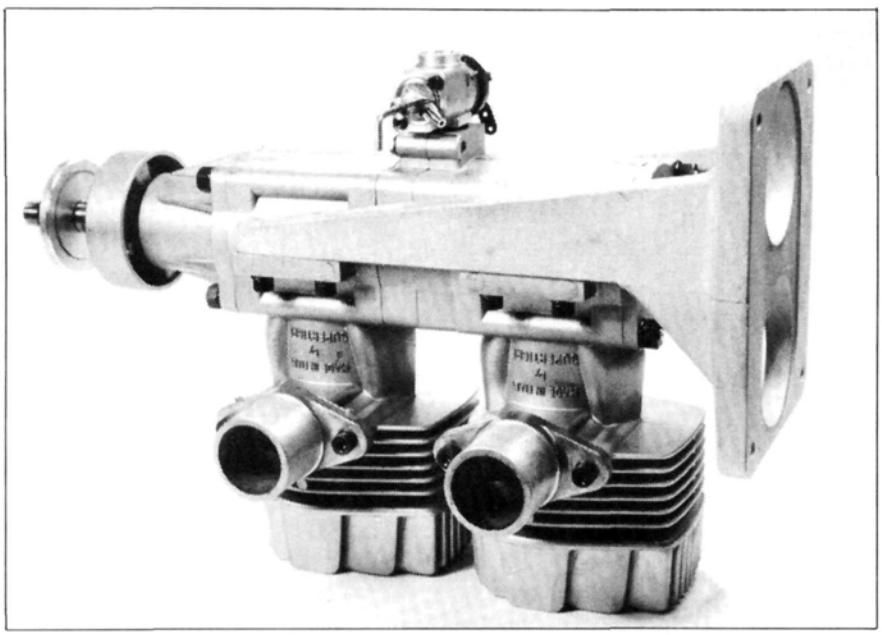
SPECIFICATIONS

Type: Air-cooled, alternate-firing, inline twin-cylinder two-stroke-cycle, with shaft type rotary inlet valve and Schnuerle scavenging.
Bore: 35.0 mm (1.378 in.)
Stroke 31.0 mm (1.220 in.)
Displacement 59.65cc (3.64 cu in.)
Nominal Compression Ratio (full stroke): 11.5:1
Speed Controt Single Super-Tigre "Mag" barrel-throttle carburetor with adjustable automatic mixture control.
Checked Weight: 2.82 kg (6.21 lb) including firewall mount and exhaust stubs.
Mounting Dimensions:
Crankcase width 54 mm
Length from prop driver face including firewall mount 240 mm
Height above CL (lessglowplugs): 109 mm
Bolt-hole spacing: 94x71 mm
Manufacturer's Claimed Power Output 5.8 PS (5.7 bhp) at 8,000 rpm.
Manufacturer Super-Tigre s.r.1., 40065 Pianoro, Bologna, Italy.
U.S. Distributor: Great Planes Model Distributors Company, P.O. Box 4021, Champaign, IL 61820.

TO THE BEST of our knowledge, the first inline twin-cylinder model aircraft engine to be offered to American model builders was produced in 1938 by an outfit called Southern Model Engineers of Nashville, Tennessee. It was named, simply, the "Alternate Firing Twin" and had a displacement of approximately 0.33 cu in. In the early Fifties, Pal Engineering Ltd., of Cedar Rapids, Iowa, produced the "Pal 55" inline twin of 0.55 cu in. and, in the early Seventies, the fine Louis Ross designed twin and multi cylinder engines included an inline .60 twin, as well as his better known horizontally-opposed engines that we tested for *M.A.N.* at the time.

All these inline two-cycle twins, along with a few others, like the British Taplin-Twin diesels, were designed as such, demanding expensive-to-make, two-throw, two-bearing, or three-bearing, crankshafts which, if not of built-up construction, also required the use of special conrods with detachable bearing caps, plus, of course, special crankcases as well as two piston/cylinder assemblies instead of just one. Consequently, such engines were relatively costly at a period when single-cylinder model engines, in general, were quite cheap. Not surprisingly, sales of twins were low.

In the nineteen-sixties, an alternative solution, strictly an amateur one at the time, appeared. This consisted of connecting two conventional single-cylinder engines together, in tandem, by means of a simple coupling between the front and rear crankshafts. In a magazine article in 1967, William Woodall told of his experiments with McCoy 19 and 35, O.S. 30 and K&B 19, 29 and 35 engines. You could buy a McCoy 19 R/C for as little as $5.95 (!) at that time. Conversion was simple. The crankcase nose of the rear engine was machined to take a special press-fitted replacement backplate for



Lengthy overhang and a weight of over 6 pounds call for a solidly integrated fuselage front end. Sturdy firewall construction will be needed to handle this engine.

the front engine. The rear crankshaft, with threaded length appropriately shortened, was fitted with a steel drive disc slotted to register with a spigot inserted into the front engine's crankpin.

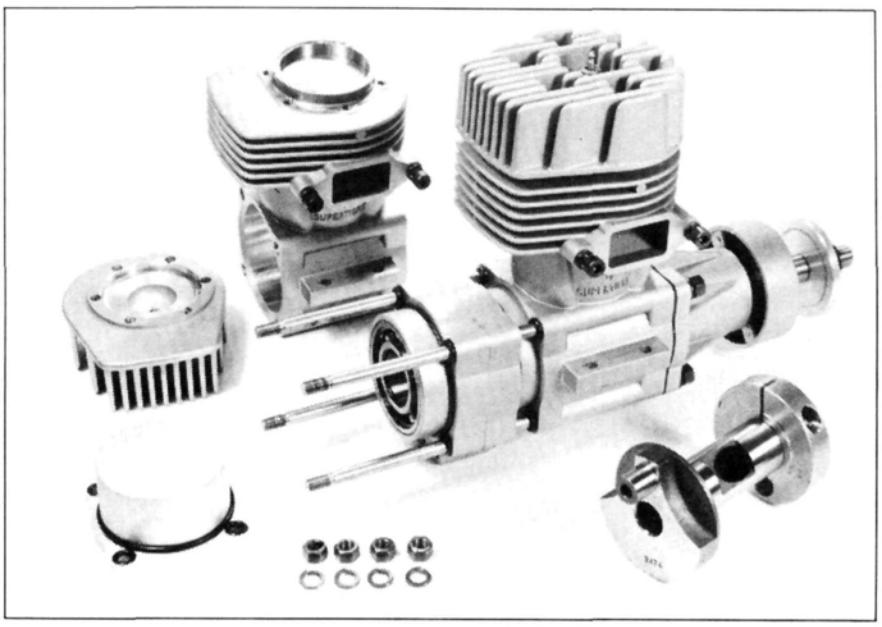
This layout of two engines coupled together in tandem is, in a refined form, the basis of the new Super-Tigre Twin-60.

Here, most of the parts of two Super-Tigre S.3000 engines are used, the essential difference being that, instead of retaining the two existing crankshafts, each incorporating a rotary-valve drawing mixture from its own carburetor, the Twin-60 employs a special rear crankshaft in a separate central housing, the shaft having twin rotary-valve ports supplied from a single central carburetor. The ports, diametrically opposed, alternately feed the front and rear crankcases.

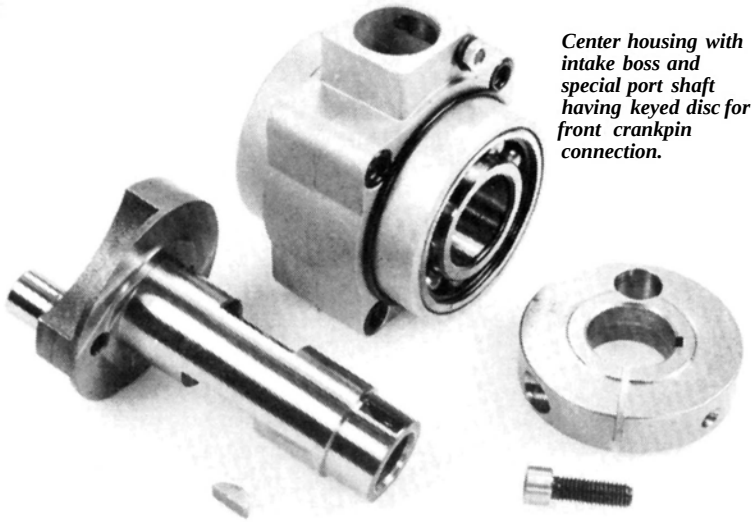
At the front, since another rotary valve is not needed, a modified front bearing housing, without an intake boss, is used and, of course, the front crankshaft no longer has a valve port. The shaft is carried in two ball journal bearings, a 20x42 mm 9-ball steel-caged bearing at the rear and a 12x28 mm 8-ball steel-caged shielded bearing at the front.

The center housing is sandwiched between the front and rear units, plugging into the two crankcase barrels, and the complete assembly of front bearing housing, front crankcase, center housing, rear crankcase and crankcase backplate are held together by four long 5 mm tie bolts. Spring washers are used under the hexagonal nuts, and recessed O-rings, rather than paper gaskets, are used between all the joint faces.

The all-important center housing is a substantial casting containing two 20x42 mm 9-ball steel-caged bearings supporting the counterbalanced rear crankshaft. At the front the shaft is reduced to 18 mm diameter and is fitted with a 45.6 mm diameter steel disc which has a full depth hole, bored through its 10.2 mm thickness, to engage the extended 10 mm diameter crankpin of the front crankshaft. The disc is keyed to the shaft with a Woodruff key and a radial slit, diametrically opposite the crankpin hole, enables the disc to be firmly clamped to the shaft



Twin-60 partially disassembled to show method of connecting two units by a center housing and shaft incorporating dual rotary valve.



Center housing with intake boss and special port shaft having keyed disc for front crankpin connection.

with a recessed 5 mm socket head cap screw.

The remaining parts of the engine are essentially the same as those of the single-cylinder S.3000 (apart from a few minor machining modifications to adapt them to their new role) and are as described in our coverage of the S.3000 in the July 1986 issue *of M.A.N.* The engine is of the Schnuerle scavenged type, with a centrally bridged side exhaust port, timed to remain open for 142° of crank angle, and four bypass ports that are open for 114°. The rotary valve which, of course, opens twice per revolution, is timed 40° ABDC to 52° ATDC, a total of 192°, which means that there is a slight overlap in crankcase charging. The carburetor, a standard Super-Tigre "Mag" type with 9 mm diameter throat and a 42 sq mm choke area, is the same as for the single cylinder engine since it only has to charge one crankcase at a time.

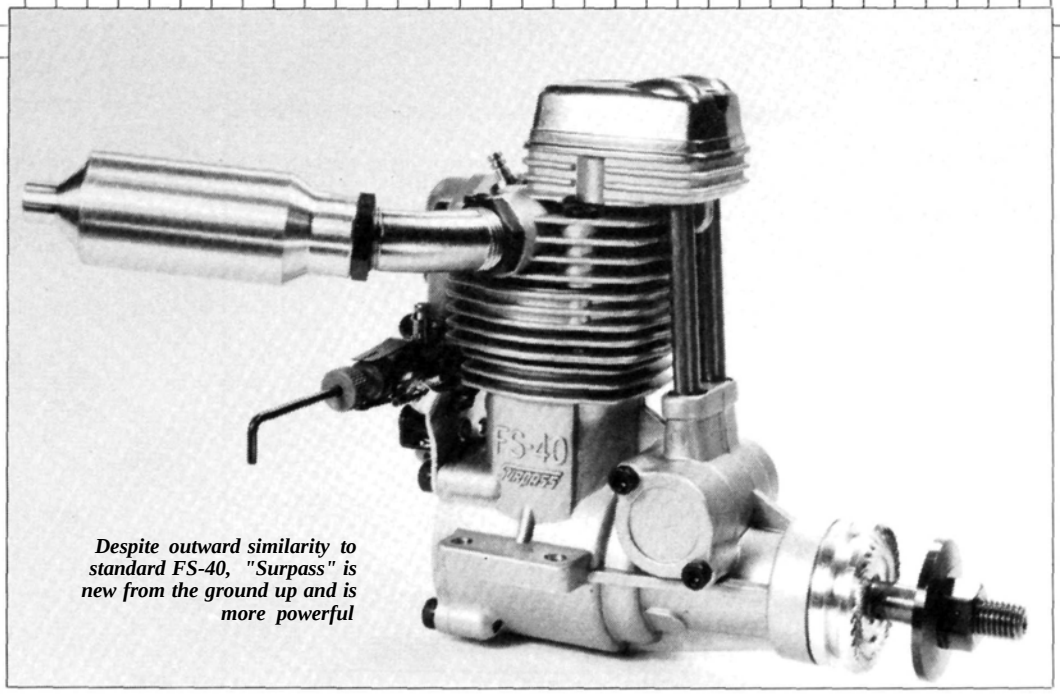
The two crankcases are bolted, via their beam mounting lugs, to a rugged cast aluminum firewall mount. With this, there is an overhang of *91/2* inches between the firewall and the face of the prop driver which, along with an engine weight of over 6 pounds, obviously calls for a good strong firewall that is really solidly integrated with the nose structure of the aircraft. Fortunately, the engine's 180° firing intervals, providing much more even torque delivery, combined with the superior balance of the twin's reciprocating masses (offset only slightly by a small rocking couple along the crankshaft axis), means infinitely smoother operation than for a single cylinder engine of similar displacement.

The factory claims a gross output of no less than 5.8 metric horsepower (5.7 bhp) at 8,000 rpm. Recommended prop sizes include: 20x11, 20x12, 22x10, 22x12, 24x8 and 24x10.

Peter Chinn, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. •

Engine Review Round-Up

by PETER CHINN

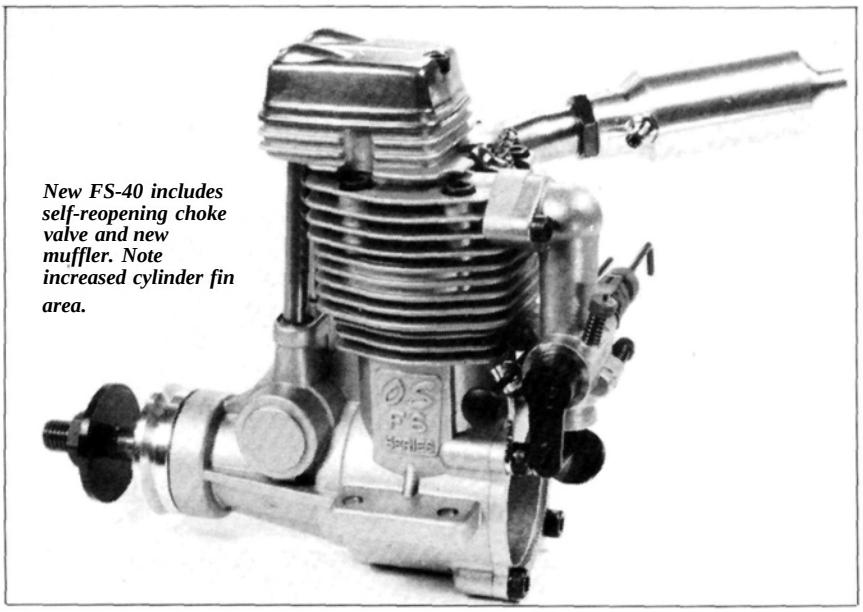


Despite outward similarity to standard FS-40, "Surpass" is new from the ground up and is more powerful

O.S. FS-40 "Surpass"

SPECIFICATIONS

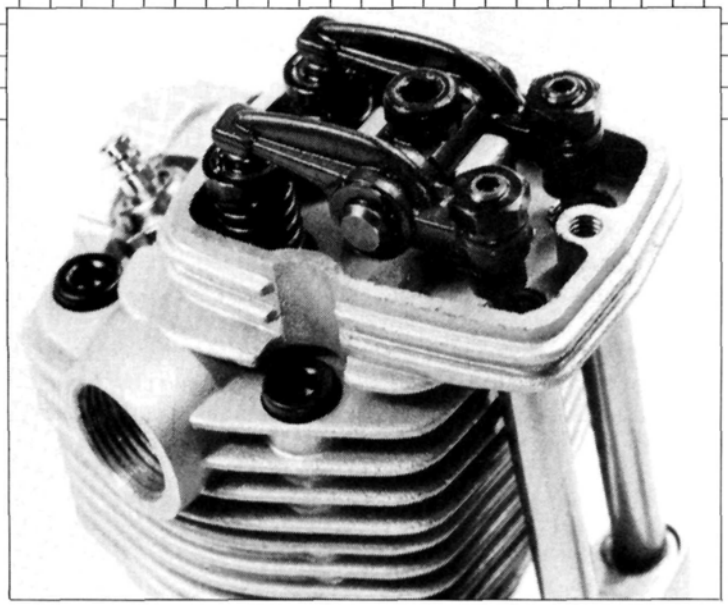
Type: Single-cylinder, glowplug-ignition, four-stroke cycle, with pushrod operated overhead valves.
Bore: 21.2 mm (0.8346 in.)
Stroke: 18.4 mm (0.7244 in.)
Displacement: 6.495cc (0.3964 cu in.)
Nominal Compression Ratio: **8.4:1**
Speed Control- O.S. barrel-throttle type carburetor with adjustable airbleed low-speed mixture control.
Checked Weights: 349 grams (12.3 oz) less muffler, 359 grams (12.7 oz) with muffler.
Mounting Dimensions:
Cranhcase width 32.6 mm
Length from prop driver face: 94.0 mm
Height above CL 81.0 mm
Bolt-hole spacing: 42.0x17.5 mm
Manufacturer's Claimed Power Output 0.65 bhpat 12,000 rpm.
Manufacturer O.S. Engines Mfg. Co., Ltd., Higashisumiyoshi-ku, Osaka 546, Japan.
U.S. Distributor Great Planes Model Distributors Company, P.O. Box 4021, Champaign, IL 61820.



New FS-40 includes self-reopening choke valve and new muffler. Note increased cylinder fin area.

AFTER SIX YEARS' production, during which time it has become just about the most popular model four-stroke engine to date, the original O.S. FS-40 has been replaced by a new model, the FS-40 "Surpass"—so called because it substantially "surpasses" the peformance of its predecessor.

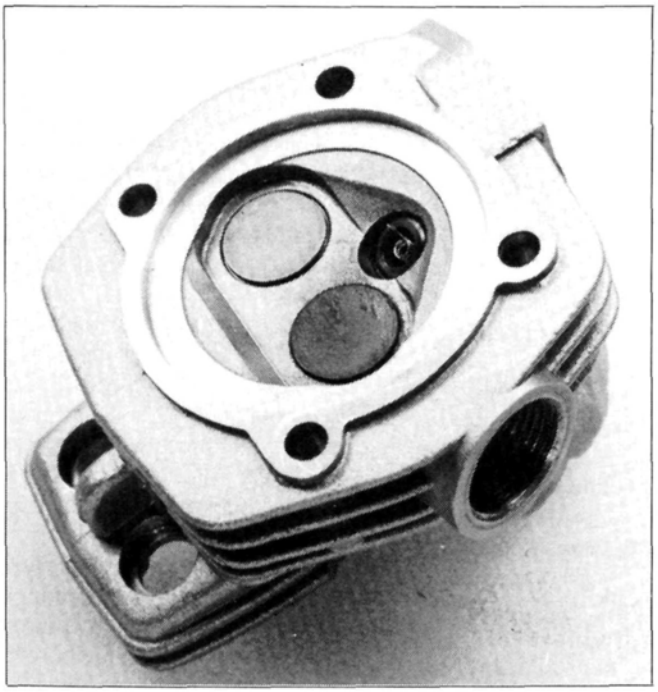
At first glance, you might suppose that the new FS-40 is simply a modified version of the original. But, place the new engine alongside an example of the old one and you will see that this is not so. The basic layout and general appearance are similar (although we think that the



Valve gear features new rockers for increased valve lift. New rocker box improves access to valve clearance adjustment.

more squat proportions, of the latest engine, give it a sportier appearance) but virtually every part of the "Surpass" is new. These include the complete body casting, the crankshaft, piston and wrist-pin, cylinder-head and rocker-box, rocker-box cover, valve assemblies, rocker assembly, camshaft, pushrods and covers, carburetor, and exhaust assembly.

It comes as no surprise to find that most of these changes have been made in the interests of improved performance and durability. The new cylinder-head and valve gear incorporate many changes. For instance, the simple discoid combustion chamber has given way to a more efficient shallow bathtub shape, with the glowplug offset toward the exhaust valve, and the port sizes have been enlarged. The inlet port diameter is now 6 mm instead of 5 mm, an increase in area of 44 percent, while the exhaust port is opened up to 5.5 mm, an increase in area of 21 percent.



New cylinder head has bigger ports and dispenses with discoid combustion chamber in favor of modified bathtub pattern.

Valve timing and lift have also been modified. Cam profiles have been changed and new rocker-arms are fitted, giving greater valve lift.

These changes to port areas and valve timing and lift are, of course, aimed at improving the engine's breathing, in order to raise volumetric efficiency and increase power. Also to this end, the carburetor has its choke size increased from 4.5 to 5.0 mm bore. The carburetor is otherwise unchanged, except for the provision of a self-reopening choke valve as standard.

Also provided is a muffler and header pipe assembly. Instead of having a 6 mm i.d. stainless steel stub pipe, fitted to the head with a gland nut, the "Surpass" has a short, screw-in, 7 mm i.d. header pipe, to which is fitted a cylindrical expansion chamber muffler with 5 mm i.d. outlet nozzle.

The robust main casting now has increased cooling fin area, the fin shape being enlarged to match the head fins. The head casting is considerably shallower, especially the upper portion forming the base of the rocker box, and the rocker shaft is now mounted separately, well above the rocker box sides, instead of passing through them. As a result, the valve stems, rockers and adjusters are much more accessible for easy valve clearance adjustment and no longer require the use of bent-tipped feeler gauges. A new, deeper, rocker-box cover is used: this has small streamlined blisters to accommodate rocker-arm movement.

As in the case of the previous model, a special camshaft is obtainable which re-times the engine for reverse rotation. This feature is particularly valuable in cases where the engine is to be installed for "pusher" operation, since it enables the engine to be used with conventional tractor props. Alternatively, in the case of a twin-engined aircraft, one can use

(Continuedon page III)

Radio-Control

by ART SCHROEDER

AS ANY long-time reader of this column knows, I enjoy any model that can be built, finished and finally controlled in its natural environment. Consequently, I've had lots of fun with model airplanes, cars and boats. And they can add a bit of spice to your life, too!

Every time I mention cars and boats in this space I receive a number of letters saying, "How dare you?" Well, because cars and boats have actually made me a better *airplane* builder and flier. They also have given me great pleasure during those many winter months when airplane flying was either uncomfortable or impossible. Cars and boats can do the same for you.

All of my R/C projects—land, sea or air—have sharpened my building and assembly skills. These projects have also kept my aging fingers in tune. And, frankly, shifting around has kept my interest in R/C at peak level.

Boats have an interesting construction style with which any aeromodeler will feel comfortable. The hull can be likened to a fuselage. Boats are often built of wood, requiring sheeting or planking, sanding, fiberglassing and all those great things we do with airplanes. Superstructures are usually boxy affairs that pose no building problems since they are made of sheet wood and formers. Detailing a boat can be as intensive and involved as any airplane, and they'll provide immense satisfaction in a job well done.

Cars really help to hone assembly skills. Parts in car kits are completely finished but their assembly can increase one's understanding of mechanics. Finishing a car has certainly improved my ability with spray paint devices and enamel paints.

Cars and boats present interesting variants to airplane problems. I've seen what wheel angles do to a car and this translates to how an airplane landing gear should be set. That wing at the rear of many off-road racers has an aerodynamic function. Boats operate in a medium which is denser than air and show similar needs to aircraft. Hulls create drag and designs are geared to reducing that drag in water. A boat requires balancing just as aircraft do, and rudders must be effective. Most cars and boats are powered by electric motors. As a result, virtually everything I know about electric power has come from surface vehicles. You can believe that has been useful with my electric aircraft projects.

Operating surface models (which should only be operated on the appropriate 75 MHz frequencies) has direct application to airplane flying. The same problem of correct inputs to an object coming at its operator or moving away exists with all three model types. Learning to handle this visual reversal with one helps with the other types. And learning in the safer, slower mode of surface vehicles isn't a bad idea. Cars and boats are a fine way for beginners to get into airplane operation if they so desire.

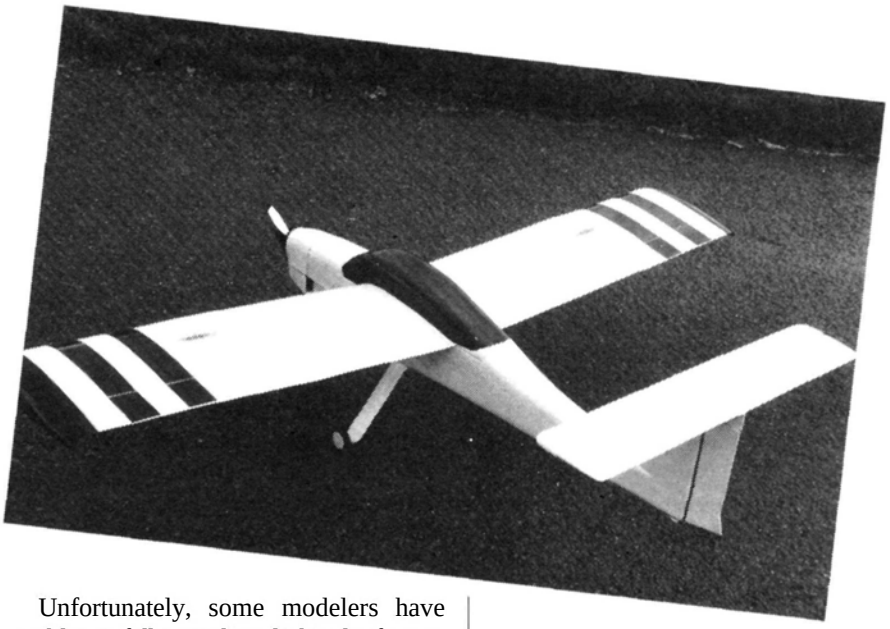
R/C flying's new blood is coming from the ranks of car and boat fans, particularly car drivers. They're young, learning all kinds of new things that include radio control of a moving object and mechanical skills. A percentage of these drivers will eventually try flying, if only to add an additional dimension to their hobby. After all, it's tough to roll or loop a car except in an accident.

The rapidly growing car and boat ranks bode well for R/C airplanes as an activity. When drivers and skippers decide to try flying, R/C model airplanes will experience unprecedented growth. That's where the R/C beginners will be found—not in youth programs. But that's another story!

This flow could go both ways—drivers, skippers and pilots all have something to offer each other. All three activities can easily be crossed to provide a lot more fun from our available hobby time. Give cars and boats a try; you might find something you enjoy. More importantly, talk to a young car driver about airplanes; he may become our next R/C pattern champ.

Midwest Has One For You...

Midwest Products'* latest boat release,



the Tour Master, is a scale presentation of a Maine-based tour launch. I've had more fun with this all-wood kit than I've had with many airplanes—and it's perfect for an entry into boating. The little boat, cute as Porky Pig, has building procedures that will be familiar to anyone who has ever built a model airplane. It's electric powered (steam is another option) and very simple to construct from a beautifully prepared kit. If you've been a "closet" skipper, this one may just be for you. I'll be reviewing it in *American Boat Modeler,* our sister publication.

Today's Building Material

How did we ever build model airplanes before light plywood (light ply)? At least that statement seems valid when looking at a lot of kits available these days.

The material is of relatively soft wood sandwiched into a three-ply format. It has replaced balsa in many kits as the material of choice for fuselage sides, formers and, in some cases, ribs. It's heavier than balsa but planned cutouts reduce weight. Lite ply is strong stuff that's very useful for building. It apparently die-cuts very well, at least the kits I've seen had very nice die-cut parts.

Unfortunately, some modelers have problems fully sanding light ply frameworks. This usually comes from a sanding approach that's not aggressive enough. Initial sanding and shaping should start with no less than 80 grit with progressive moves to 200 grit and finally to about 320. If you "baby" light ply with lighter-grade sanding papers you're going to **put** a lot of work into finishing that's not really needed.

A problem I've had with light plywood is the roughness and fraying around end grains such as exposed inner ply where window openings are die-cut or at fuselage corners. I've found that thin cyanoacrylate flowed into these edges, followed by sanding and a light coat of vinyl spackling is a way to clean up these areas.

Gluing light ply is handled very well by gap-filling cyanoacrylate. An accelerator is very helpful since the glue doesn't seem to cure as quickly on the harder wood.

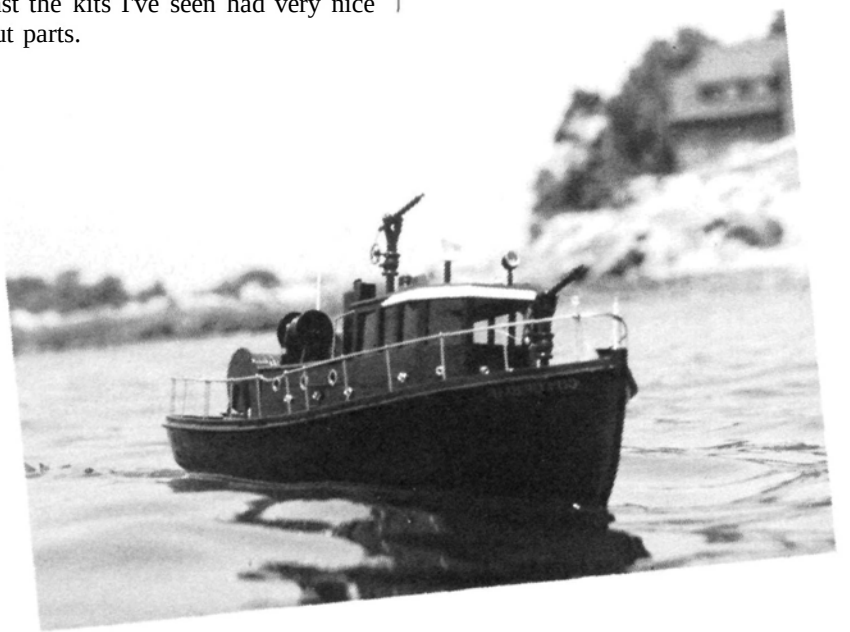
I've had better results covering **light** plywood with heat-shrinking plastics and fabrics when I pre-treat the material with Balsarite. It is also imperative that all surface moisture is gone from the plywood before covering. The old trick of allowing the bare framework to sun bake for five or six hours really works.

Light ply isn't a substitute for balsa, it's simply another option. It does provide rugged structures that bear up to vibration **and** rough landings, or even crashes. So, when you see light plywood as a primary building material in a kit, don't avoid it; it's darn good model airplane stuff.

Art Schroeder, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in this column:*

Midwest Products, P.O. Box 279, Ida Grove, IA 51445. •



Carl Goldberg Models

ULTRACOTE

How to use this state-of-the-art covering.

by RANDY RANDOLPH

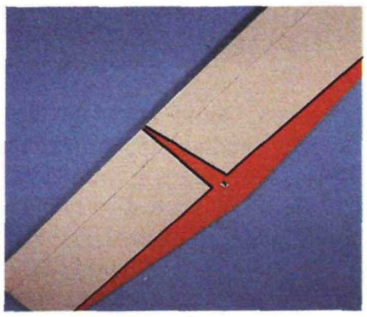
BEYOND DOUBT, plastic films have become *the* covering material for model airplanes. With the exception of small rubber-powered models, there is a film for all applications. I have been in love with the Top Flite's* Super MonoKote from its introduction. When Coverite's* Micafilm came along with its very light and tough finish, it became the first choice for smaller airplanes. Big ones, too, if weight was a factor.

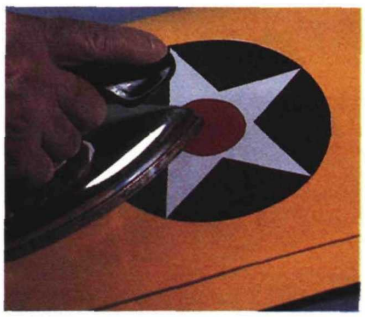
Now, the next generation of films is with us. Goldberg's* Ultracote is one of these new generation films.

Just as I fell in love years ago, I am again smitten! Ultracote is truly easy to use and the results look more like a well-rubbed painted finish than a shiny plastic one! Scale purists take heart; this material may save you lots of time and eliminate that paint smell your family likes so well!

As with all covering materials, surface preparation is important. Blemishes will show unless they are smoothed away before the covering is applied. Final sanding should be done with 320-grit paper and a sanding block. Next to the razor knife, sandpaper is the very best tool available to modelers and none of us spend as much time with it as we should.

The instruction sheet that comes with Ultracote is a good one. We have grown to expect good instructions from these people over the years and it speaks well of their feeling for the modeler. The backing, which keeps it from sticking to itself, seems to be a waxed butcher paper and the film just slips away from it with no static electricity buildup. Sounds like a small thing, but in cool, dry weather, that static charge can be a real pain! The film itself has a somewhat flexible feel and the glue side is quite obvious. There is no excuse for covering the iron instead of the airplane!





Ultracote comes in all popular colors and can be painted with quality polyurethanes. It forms a tough, wrinkle-free covering that is easy to maintain. Pinstripes can be sliced with a straightedge and razor and ironed in place. Ultracote can be ironed over itself with little bubbling.

The film drapes well over the surface to be covered, which makes ironing to the framework a bit easier. Like all films, the outside edges of open areas should be sealed first, then the film shrunk tight and wrinkle-free with the application of heat. Ultracote is rather flexible about the temperature it can accommodate. A lower setting (250°-300°) when applying the film over itself not only eliminates bubbles, but with the re-application of heat allows for the lifting and replacement of the covering. Higher heat can be used to shrink or mold it around compound curves as well as for balsa-sheeted surfaces. The melting point is 500°. Once shrunk, it adds strength to the structure and is no longer flexible.

As covering progresses, the tendency is to get sloppy with technique because the film is so easy to use. Even with sloppy application, it's forgiving! I deliberately ironed-in folded wrinkles around the edge of one surface; they disappeared when the film shrank. Good stuff.

The glue will soften when heated, so it's a good idea to avoid the seams when shrinking. I use an iron to smooth the wrinkles away while staying away from the seams. A small disadvantage for all the benefits offered.

When the transparent "new wave" films are available, it will be another happy day for me. I like see-through wings against a blue sky!

**The following are the addresses of the companies mentioned in this article:*

Top Flite Models, 2635 S. Wabash Ave., Chicago, IL 60616.

Coverite, 420 Babylon Rd., Horsham, PA 19044.

Carl Goldberg Models, Inc., 4734 West Chicago Ave., Chicago, IL 60651. ■

Field & Bench Review

Type: *FAI Turnaround Pattern*
Wingsparu 67 inches
Area: *830 square inches*
Power: *.61 2-cycle, 1.20 4-cycle*
Weight: *8.5 pounds*
Channels: *5*

by MIKE LEE

Craft-Air Checkmate 60

An ultra-clean Turnaround competitor.

Mike Lee poses with Checkmate; large pattern ship uses an O.S. Long Stroke.

NO ONE WILL ARGUE the fact that FAI style of precision aerobatics, known more commonly as Turnaround pattern, has spurred the growth of a new generation of aircraft. The style of Turnaround dictates the need for a more realistic style of flying for a model, along with the requirement to maintain the model's ability to perform at the current performance levels as the screaming AMA-type birds. That makes for a tough bill to fill when you consider that the aircraft must perform within the restricted airspace of the "box."

When the Turnaround pattern was first being flown, many pilots went to four-stroke-powered scale-type ships. This didn't last too long after most found that they could not derive the clean maneuverability that the thoroughbred pattern birds possessed. Although the four-strokers were able to provide the needed urge, the airframe couldn't get the urge.

The trend then went back to the clean pattern birds but stopped just short of using the same ones used in AMA. Instead, some designers made the birds even cleaner in order to make the most of the airframe while reducing overall speed. The key was to make an airframe that would be slightly slower than the AMA birds in level flight but be able to perform the vertical maneuvers just the same. The answer was found in using a larger but thinner percentage wing platform, using longer pipe length on the same engine, and keeping the airframe weight low.

One of the most recent designs which fits this criteria is the subject of our Field and Bench review, the Craft-Air* Checkmate. This ship was originally designed by FAI and Masters class veteran Steve Helms. Steve's original Checkmate was a beauty in anyone's book, even if the ship was sitting on the ground. Its airborne capabilities proved to be a good combination for the FAI maneuvers, with Steve making good use of it in many competitions.

THE KIT. The Craft-Air is based on this original design, being constructed of a balsa-and-plywood fuselage, foam wings with balsa sheeting, and a fiberglass belly-pan to fully enclose the engine and tuned pipe. The finished plane will span 67 inches, stretch some 63 inches from nose to tail and have a wing area of about 830 square inches. The Checkmate kit is not for the novice builder.

CONSTRUCTION of Checkmate begins with the foam wings, in our case. This is a large aircraft that requires prior building experience to complete. This being the case, the instructions of the Checkmate are not highly detailed as most experienced builders already

(Continued on page 74)

Tech Tips

Sporty Scale

by RICH URAVITCH

Documentation Sources

WE RECEIVE a lot of mail from readers interested in scale and a couple of the questions most typically asked go like this... "I'm just about finished building and need some help with the color scheme." Or, "Can you please advise me about where I may obtain three-view drawings of the Curtiss P-40E Warhawk which I can scale up to 1/5-size?"

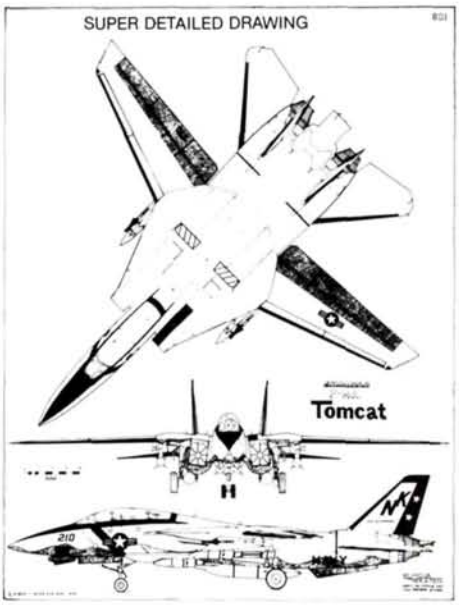
It seems that throughout our hobby, as one's involvement grows so does one's neglect. A lot of the information and documentation sources which I use without a thought may not be very well known to other modelers.

Some of the mail I've received lately has included material from some fine documentation sources. I thought I'd give you the name of the outfits and say a few words about what they've got to offer.

Scale Model Research, 2334 Ticonderoga Way, Costa Mesa, CA 92626. This outfit, headed by Bob Banka, specializes in "Foto Paaks," which is a kind of full-color "walk around" study of a specific aircraft. The sample I received of a Bucker Jungmeister was of good quality and appears to have been taken with the modeler in mind—good overall views rather than dramatic "Madison Avenue" shots. Each Foto Paak consists of at least 12 different views of the subject with 20 shots being more typical.

Included are elusive cockpit shots along with detailed studies of control surfaces, landing gear, and cowling; all the things we scale guys really love! For less than 65 a photo, it's sure hard to beat. With over 400 aircraft listed, they should be quite able to satisfy your needs.

***Koku-Fan** magazine from Japanfeatures superb color photography plus modeling section.*



Detailed three-views, a modeler's best friend for scale documentation.

Scale three-view drawings from the Japanese magazine, *Koku-Fan*, are also available exclusively from Scale Model Research. I've been a subscriber to *Koku-Fan* for over six years now and am quite familiar with the drawings available.

Prepared by the noted aircraft illustrator, K. Hashimoto, they represent some of the finest examples of scale drawings I've ever seen. For a complete listing, send $2.00 and a self-addressed stamped envelope to these guys; you won't be disappointed.

Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403. Dr. Lyle F. Pepino is well known in the scale modeling community and has a service especially geared toward the scale modeler. Three dollars will get you his complete catalog, but here's a bit of what he's got: photo packs (color and black and white) of over 500 different aircraft

Techniques

Cessna T-37 "Tweet" in special experimental finish of Air Force blue and white.

from Aeronca to Zlin. Lyle knows what the modeler needs and photographs the subjects in a highly "usable" manner. Kit-type plans with all ribs and bulkheads are shown and some include documentation, three-view drawing, and cutaway.

There's also scratch-builder enlargements of all WWI subjects, some done from factory drawings. These drawings are suitable for advanced modelers who can convert exact scale drawings to usable modeling plans; unless the end result is going to be an exact rib-for-rib scaled-down replica! There are Eindeckers, Nieuports, Sopwith Dolphins, Pups, and Snipes with wingspans in the 72- to 80-inch range. There's a lot of good four-cycle or Quadra material here.

Finally, if you have a favorite three-view you'd like enlarged, Scale Plans and Photo Service will do that for you also. A modest charge per set is all it will cost for a blue line blow up of that "ultimate" scale project you've been wanting to do!

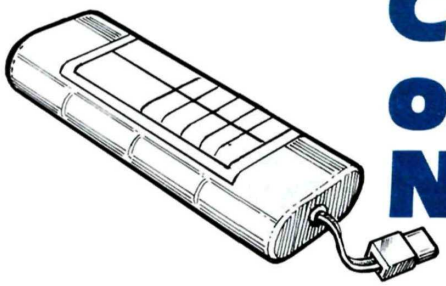
Repla-Tech International, 48500 McKenzie Hwy., Vida, OR 97488. Although I haven't personally ordered anything, some of my modeling buddies have told me that this outfit has a catalog for $3.00 which includes plans, photos, and books. I've seen some representative drawings and they appear to be quite accurate and frequently include sections.

Bob H o l a n Plans, P.O. Box 741, San Bernardino, C A 92402. Old buddy Bob is probably one of the single greatest sources for scale model plans I know of. A lot of the very successful scale designs from Europe are available from Bob, many in semi-kit form with fiberglass accessories. These include the Brian Taylor and Dennis Bryant designs for some great airplanes like the Cessna 120, the Vultee BT-13, and lots of other interesting machines.

Last, but not at all least, is *Koku-Fan* magazine. You don't have to be a modeler to enjoy this publication, just a love of great aircraft photography will suffice. Most of the subjects are military but some civilian coverage is included. The magazine is published monthly, and averages around 160 pages, some of them in the most magnificent color I've ever seen. Although it's printed in Japanese, an English translation supplement is included. The cost is about $6.50 per issue, which isn't bad for a magazine which could be considered the *National Geographic* of the aerospace world. Contact **Bill Dean Books Ltd., 166-41** Powells Cove Blvd., Whitestone, NY 11357.

These services and publications should help you to secure the data you desire and are certainly worth the cost of the various catalogs and listings—tell them I sent you—they'd like to know. •

Left, Bucker Jungmeister from Scale Model Research "Foto Paak." One of 1,400 subjects available. Right, Canadair Tutor of the Canadian Snowbirds demo team.



Care and Feeding of the Ni-Cd Battery

by REED KALISHER

Important facts about these popular batteries.

DRIVING TO MY buddy's house, I couldn't help but notice how calm it was for a fall day. After a cup of coffee, and a few good "You should've seen that flight!" stories, we headed off to the field. To make a long story short, we started out with seven airplanes among five pilots. Within an hour, we'd lost four aircraft!

One crash was obviously a case of pilot error, but the other three were due to flight-pack problems. All of the planes had been charged overnight, and appeared to be okay during pre-flight checks, yet three of them turned up with unnoticed battery trouble.

Above: By splicing Dean connectors to original charging jacks, one cycler can service many systems. Left: The cycler displays time of discharge and then automatically recharges the battery.

Although you can't stop *all* equipment problems, with a little effort and some inexpensive gear, you can greatly reduce one of the biggest problems you'll encounter—battery failure.

The first thing I'll talk about is how Ni-Cd batteries work. I'm not going to get all technical about this, but I'm sure you can remember how when you were a kid the toys powered by ordinary carbon batteries gradually got weaker and weaker until they were useless.

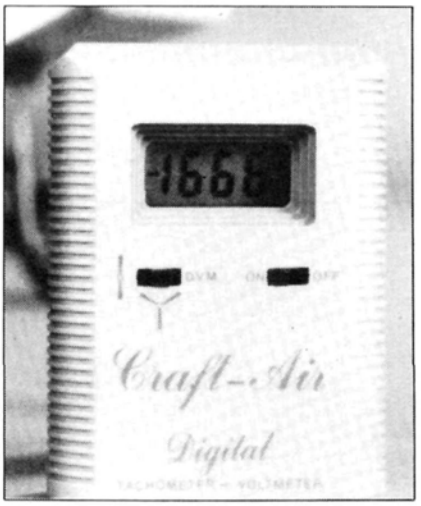
Ni-Cds run pretty close to full output with only marginal fatigue until they reach their limit. At this point they become dangerous, since they'll do a sudden nose dive in power, and so might your plane.

The reason for this is that at or below 1.1 volts per cell, they tend to reverse polarity. When this occurs, they no longer have any power output, and your R/C plane (or car) has just become "free-flight."

So, how do you know when to stop flying? Well, there are ways of making charts and graphs to get an idea about your batteries' life expectancy. Or, you can count the number of flights and do your "best guess" routine.

None of these methods are very accurate due to a number of reasons, including load and duration variances, and battery memory. We'll talk about memory a little later on, but first let's go over battery life in the field.

Probably the best way to know the condition of your battery pack is to use a measuring device that puts out a simulated load and tells you how much power is available. An Expanded Scale Voltmeter (ESV), or a Digital Scale Voltmeter (DSV), is the best way. Craft-Air*



Digital scale voltmeter from Craft-Air can also serve as a tachometer.

makes a DSV that's a real bargain when compared to the cost of a lost ship. There are a few others offered by Ace R/C* and Litco*, but the Craft-Air (No. 515) also has a tachometer built into it which makes it even more useful.

Let's assume your flight pack is a typical 500 mAh. The pack when charged should hold approximately 4.8 to 5 volts. Your DSV will tell you if you're fully charged. As you drain the charge, it will drop slowly to about 4.4 volts. At this point you should *stop* flying. Below 4.4 volts, the rate of discharge increases drastically, and at this point polarity reversal could occur. Actually, if you don't have a field charger to boost your packs, you should stop before you reach 4.4 volts. Be careful not to fall into the "memory trap." Let me explain further.

You've been flying for six full flights. Your experience tells you that you should be able to go for three more. (A well-conditioned and fully charged 500 mAh power pack should provide about 10 flights of 10-minute duration.) The DSV reads 4.6 volts remaining. You're only in the air for about four minutes when yon begin to lose it. If you're lucky, you get a second chance. What happened? The DSV showed plenty of reserve, or did it?

If you typically go home with a good reserve of power left in your flight pack, say 4.6 volts, the battery will give up its charge faster. Instead of falling below 4.4 volts, it will display the same behavior at an earlier stage, say around 4.6 volts.

This is known as "memory." If you don't fully discharge the cells before 4.4 (1.1 each) volts are up, and recharge them to full capacity, they'll develop tiny spikes inside. The engineer who explained this to me called it "growing hairs." Anyway, these "hairs" cause minor short circuits inside the cell. The more hairs, the faster the cell discharges. The hairs cause the pack to appear to develop a memory in transmitter and receiver batteries. They seem to "remember" to discharge faster!

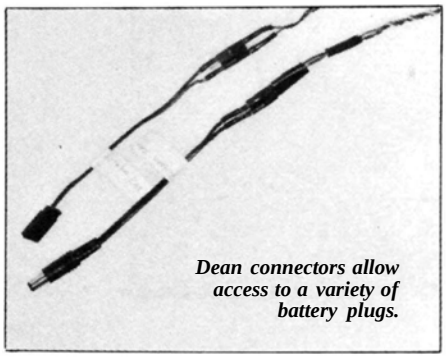
This is where the other half of the proper care and feeding of a Ni-Cd comes in. Imagine your battery as a rubber band. If you pick up a new one and rapidly stretch it to a length you thought it should go to, it will most likely snap. If you lubricate it, and extend it in short stretches first, it'll survive.

Remember to cycle your batteries! Regular cycling is just like conditioning of rubber bands. Full discharge (to 1.1 volts per cell) and full recharging, or deep cycling, will prevent or erase memories in your battery packs, and help them to perform better. This is because full discharge and recharge will burn off most of the hairs, and allow the battery to function normally.

Battery cyclers are offered by Litco (Multi-cycle), and L.R. Taylor (Power Pacer), and Ace (Digi-pace 1). They can cost from $60 to $90, but are worth every penny. My personal favorite is the Litco Multi-cycler because it switches to a trickle charge when it's complete.

Attach your fully-charged transmitter to one side and the receiver pack to the other. Turn it on, and a timer will count the time it takes to reach 1.1 volts per cell. At this point, it will then recharge the packs to capacity. Use the manufacturer's recommendations to determine the condition of your battery packs. If you've never cycled your packs, repeat the process until the lifetime reading stops getting longer than the previous cycle. Each complete discharge and recharge cycle should take between 12 to 18 hours.

By the way, cycle your brand new radio and power pack too! Most manufacturers put a charge into the packs to check them, and protect them against reverse polarity. Then they sit in the warehouse and on the store shelves where they begin to degrade. Never presume that the batteries are okay just because they're brand new; cycle them! If you own different brands or models that require the use of different connectors, I recommend you splice-in sets of Deans connectors. This will allow you to attach any piece of battery equipment at any given time.



Dean connectors allow access to a variety of battery plugs.

Other reasons for premature battery failure include poor linkage hookups. If the servo is overworked or stalled, it could pull three to four times the normal amount of juice needed, and drain the flight pack faster. Vibrations and rough landings could also destroy a healthy cell. Inspect the batteries regularly, keep them well padded, and replace them when in doubt. If you're hanging the planes up for the winter, cycle the cells, then store them in a cool, dry place.

During flying season, cycle about once every four to six weeks. During the non-flying times, cycle them every two to three months, and again before you resume the season. Be careful not to overcharge the batteries, especially when using "quick" chargers. A regular charger should be rated at about 1/10 of the mAh rating of the complete pack it's charging. A 500-mAh pack charger should be rated at about 50 mAh. A quick charger is usually about 30%, or in this case about 150 mAh. If you don't watch the time on the charge, you'll cook the cells. Some chargers monitor the battery charge level and change to a trickle charge when complete. A trickle is about 1 % of the battery pack rating (5 mAh) and can be connected indefinitely. Check the manufacturer's specs for charge time or talk to your local hobby dealer.

These basic rules will not prevent all failures, but cycling and DSV (or ESV) use combined with physical examination for damage, will extend the Ni-Cd battery life and help it to perform in a very predictable manner.

**The following are the addresses of the manufacturers mentioned in this article:*

Craft-Air, 6860 Canby Ave, Suite 120, Reseda, CA 91335.

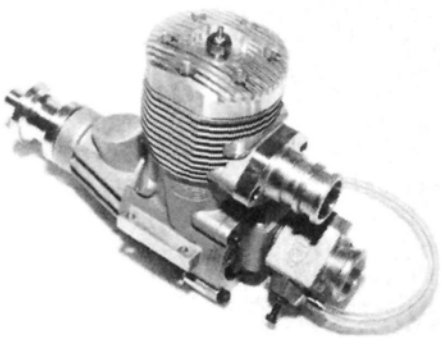
Ace R/C Inc., P.O. Box 511C, Higginsville, MO 64037.

Litco Systems, Box 90, East Hanover, NJ 07936.

Jet Blast

by RICH URAVITCH

ONE OF THE gnatty problems confronting us "jet-setters" is that of assuring uniform delivery of fuel to our high-performance engines. The problem is compounded by the voracious appetite these engines have, in most cases demanding the use of multiple, high-capacity tanks. In many cases, with the .40 to .45 (5-inch) fans at least, a single 14- to 16-ounce tank can be used as long as you accept abbreviated flight times as the norm. The larger .65 to .81 fans generally use connected tanks with a total capacity of 18 to 24 ounces. The scheme shown here illustrates the method

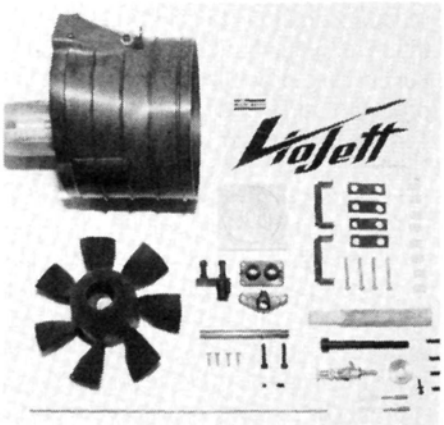


"Engine of choice" for the Viojett, KBV .72. Power galore, quality item. Note "hard" engine feed line.

Bob Violett Models* employs on their Sport Shark series of airplanes. Bob's tanks are custom-molded in a kidney-shape which allows them to be tucked in close to the fan unit with the side advantage of being near the CG. The critical thing in this installation is to maintain equal fuel line length from the T-fittings. The system has worked well on all of the Sport Sharks and Agressors I've seen and there's no reason 1 can see why it couldn't be adopted for nearly any airplane installation. Bob's newsletter, the *Inlet,* includes handy tips like this which are of great interest to us fan folks. Bob gets $ 10 per year for a bimonthly subscription and, although it naturally features his products, it contains a good deal of useful ducted-fan data with general application.

Sterner Engineering "Sport Fan," a simple approach to successful entry into ducted-fans.

I just received my Viojett fan unit along with the KBV .72 engine. I haven't done anything except inspect, examine, caress, and talk nicely to it as yet, but initial observations are that the package is



Viojett fan unit with its bits and pieces. Shroud features designed in engine cooling provisions.

quality all the way. All of the fan unit components are unique with apparently a good deal of design and development forethought expended (not to mention obvious bucks!). Even seemingly simple things like aft centerbody fairing attachment fittings are designed specifically for this application. The fan unit is a "tractor" configuration with three fixed geometry stators and a seven-blade rotor. The instructions appear to be comprehensive and can answer almost all questions. The KBV .72 looks like a brute of an engine and reports are that it performs well. A full-blown report will follow when I finish my Jet Hangar F-86, a Tom Sewell BD5J, and a Sterner Engineering T-33. That will give me the time 1 need to save my money for the Aggressor kit. Any Sport Shark fliers care to help out with their experiences?

Sterner Engineering* has released their kit of what has to be one of the easiest to assemble, simple approaches to ducted-fan flying ever. I mentioned it a couple of columns ago, but here are some photos. Kerry took me through the kit at Toledo and it looked great. The video bore witness to its performance capabilities which looked impressive. The Sport Fan is modeled after the real RFB Fantrainer and uses the Byrojet fan unit. The proto-

type, shown in the video, uses a Rossi .81 but Kerry intends to bring a side-exhaust .61-powered version to the upcoming Canadian Jet Rally. This should really appeal to the sport fan flier. One of the unique features of the kit is the use of a composite-construction fuselage keel to which is added the fan unit, radio, and other equipment. A fiberglass forward fuselage shell is then slipped in place to perform the cosmetic "look pretty" function. This kit should be a big hit with the newcomers to fan flying.

We often hear about how fast some of our jets are—mostly undocumented and oftentimes unrealistic. At *M.A.N.* we're doing something about this. We're acquiring a radar gun which we'll use, hopefully, to get some accurate speed readings on some of our test subjects. You guys looking to time your airplanes can get some reasonably accurate results with a stop watch, a calculator, and the following two step formula:

1. D = distance (feet)
   T = time (in seconds)
   V = speed (Feet/sec.)

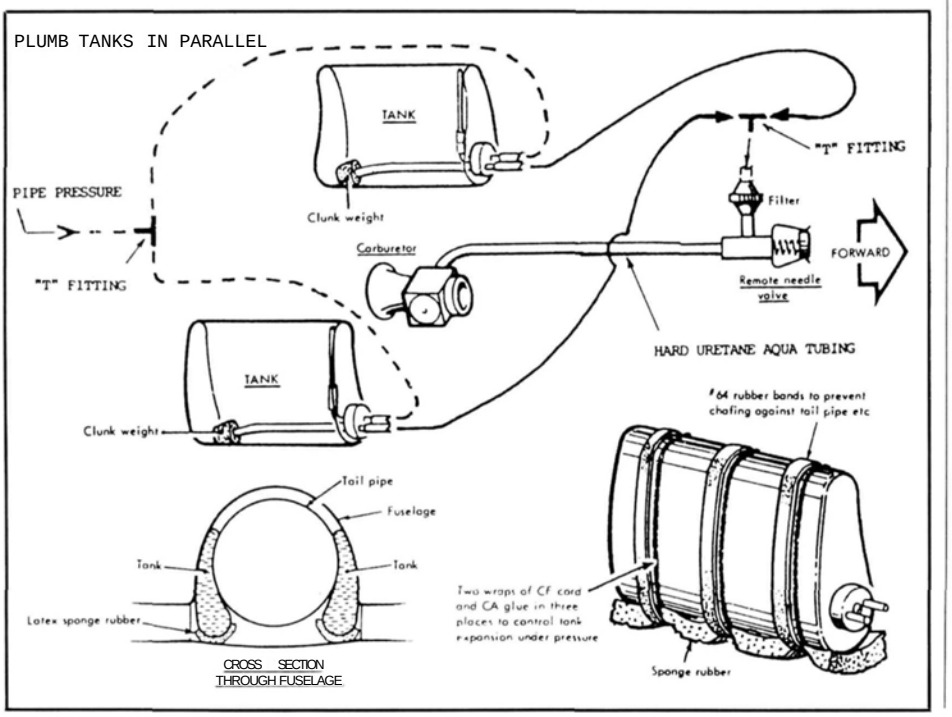
$$\frac{D}{T} = V$$

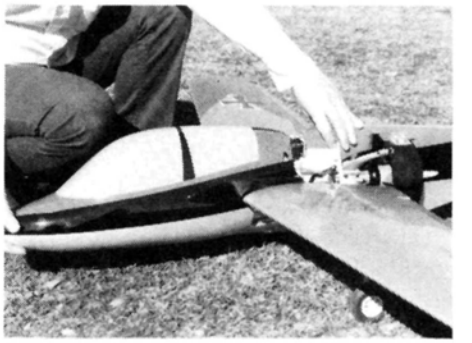
2. $$\frac{Vfps}{1.467} = Vmph$$

For example, assume a measured 500-foot course with a flagman at the starting point, observed by the timer (with stop watch) at the finish point. The flagman drops a flag when the aircraft passes the start line. The timer starts the watch and stops it when the aircraft passes the finish line. Suppose the stop watch says 3.7 seconds, applying the formula:

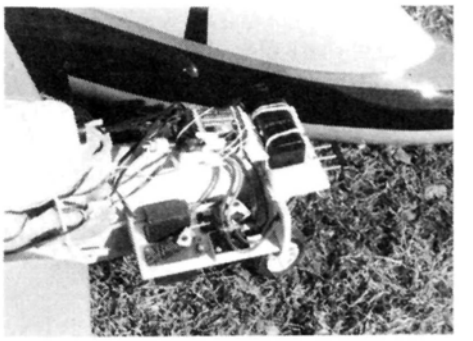
$$\frac{500 \text{ (course distance in feet)}}{3.7 \text{ (time in seconds)}} = 135.1 \text{ fps}$$

$$\frac{135.1}{1.467} = 92.1 \text{ mph}$$





Sport Fan design features removable fiberglass forward fuselage which covers radio, fuel tank, and nose retract.



Nose platform assembly with glass fuselage removed. Ultimate in accessibility.

In this speed range, each tenth of a second represents a range of approximately 3 to 8 mph, so accuracy of timing helps. A few passes to establish an average will also help. Most of the fan airplanes today will cover a 500-foot course in 2 to 4 seconds—that's a speed range of 85 to 170 mph. The chart will save you the calculations—if you use a 500-foot course!

For peak performance, stay tuned....

Rich Uravitch, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the manufacturers mentioned in this column:*

Bob Vblett Models, 1373 Citrus Rd, Winter Springs, FL 32708.

Sterner Engineering, 661 Moorestown Dr., Bath, PA 18014. •

Small Steps

by RANDY RANDOLPH

THE FOLLOWING is about an organization called "The Colleyville Texas Soaring Club," but because they also power their sailplanes with small engines they qualify for this column. The name does not cover all the activities this group pursues, for they are active not only in R/C, but free flight and indoor as well!

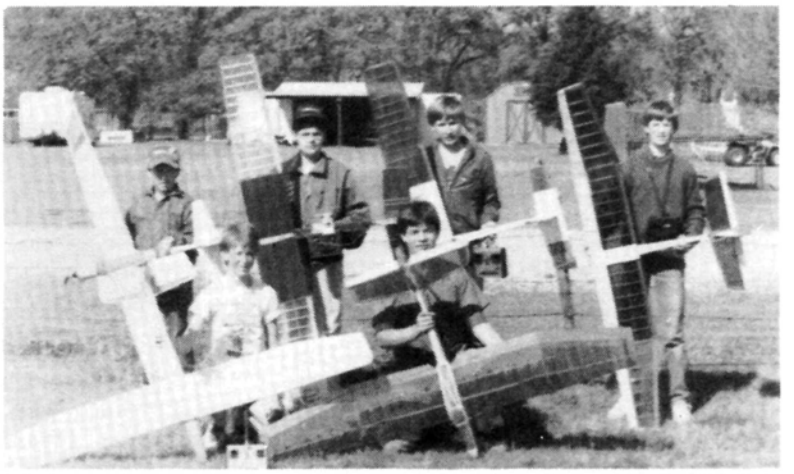
Colleyville is a community of small ranches located just north of the Ft. Worth-Dallas metroplex and all members of the CTSC fly R/C in their backyards! As you would imagine, flying sessions are almost daily. Since all of the members are students, the flying takes place after school and on weekends. Jeff Butt is the spark plug and spokesman for the club. His phone calls and salesmanship brought the group together and their common interest forms the bond.

Note in the photos Bruce Dolls' Weekender. Bruce lives in Flint, Michigan, and fitted this airplane and an *M.A.N.* design, the Sportster 20, with skis for winter flying.

Bruce writes "...I fly with skis in the winter, nothing like a cold, clear Michigan winter with powdered snow and touch-and-go's to get the blood flowing. There are 3 good things about winter flying: 1. low humidity and thus more lift; 2. engines, both two- and four-stroke, run better, and 3. you never have trouble getting the frequency clip.

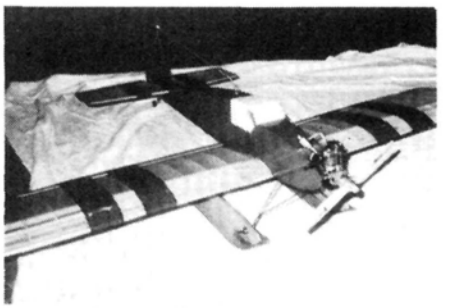
"The Weekender has become one of my favorite flyers. I scratch-built it from plans in *Model Aviation* and it was a design by your "uncle" L. F. Randolph. Powered by an O.S. .20 FS, it will fly forever on a 4-ounce tank. Rigged for skis, it is real winter-time fun."

Jeff Dalton cranks his Black Widow-powered Sportavia; Colleyville, Texas, member.



The Colleyville Texas Soaring Club (l to r, kneeling): John Butt and David Tabor; top row: Michael Neff, John Monies, JeffDalton, and Jeff Butt.

Bruce continues about the G-Mark .061. "...This engine, made by the Citizens Watch Co., is a real 'jewel' and one of the finest 'throttleable' small engines on the market today. I think it is imported by Cannon. They take a long time to break-in, but once broken-in they'll idle right down. A Tee Dee .049 or .051 has more brute power, but you can't beat the G-mark for easy handling, plus it has its own muffler...."



Bruce Dolls' O.S. FS-20-powered Weekender on skis. He gives three good reasons to fly in winter.

Bruce included some color shots of his Sportster 20 as well as a G-Mark powered Eindecker and a Mini-Fledgling along with his Seamaster II and Undertaker. All good-looking airplanes, unfortunately we are unable to reproduce color shots so I can't share them with you. Please remember to enclose black and white photos with your letters.

The last picture is an oldie of two .20-powered Paskeys built by John Krumbholz and Joe Kelley from *Model Builder* plans. These guys were the scourge of the fun-fly circuit for a long time. An airplane of this design was also flown by Eddie Williams during the Sunday noon show at a Southwestern Championship meet. It was absolutely unforgettable! That airplane and pilot did things that simply cannot be done, and did them all under 50 feet of altitude!

Paskeys by Krumbholz and Kelly. Small frisky airplanes like these keep you awake.

Thanks for dropping by and keep those cards and letters coming.

Randy Randolph, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. •

Byron Originals

F-15 EAGLE

by MARK FRANKEL

Type: *Scale*
Wingspan: *70 inches*
Length: *8 feet, 9 inches*
Power: *Twin O.S. .77*
Weight: *28 pounds*
Channels: *6 with speed brake*

I JUST RETURNED from a local general aviation airport where we flew the Byron* 1/7-scale F-15 from a vacant runway. A huge model by any standards (nearly 9 feet long, over 30 pounds in weight carrying 40 ounces of fuel for engines that produce a combined output of nearly 8 horsepower, which translates into 24 pounds of thrust), the F-15 attracted the attention of the entire airport community, line boys to corporate pilots. All watched in awe as the twin Rossi .81s spooled up to nearly 20,000 rpm and the Eagle began to accelerate, growing

Get ballistic with this twin-Byro-Jet-powered missile!

light on its wheels. My first impression was how realistic the model looked when the landing gear shock struts extended as lift was generated. Some back pressure on the stick lifted the nose, and in a few yards the model established a positive climb. My second impression was the speed of this giant jet after the gear was retracted. We had no means of measuring the speed, but all witnesses agreed that it was well in excess of 100 mph. Several passes across the runway allowed us to verify the response of the controls on all axes. I observed the supreme stability of the airplane in straight and level flight; it tracked like an arrow.

A favorite maneuver of jet modelers, often used to display speed, is a long descending pass leveling out about 50 yards before the audience and passing by at eye level for another 50 yards upwind (downwind passes are even more spectacular). We tried one such pass with the Eagle in a slightly banked attitude—the corporate pilots and line boys let out a gasp! A climb out to the right, followed by a left-hand turn cross-wind put us in position to throttle back and drop the gear. The starboard Rossi (right, to you non-Navy types), which refused to idle reliably, flamed out; but we continued the left-hand pattern with no problem. Since the F-15's thrust lines are inches from the aircraft's centerline, the model didn't yaw on the asymmetrical thrust. Rolling from base leg onto final, the Eagle displayed the only surprise of the flight. As the power came back, the nose began to rise, requiring some down elevator to maintain an appropriate angle of attack. This tendency can be trimmed out, but it was mildly discomforting to hold forward pressure during the descent. My fourth impression was of the model's leisurely approach speed. A few feet above the ground the nose was allowed to rise and the F-15 touched on the mains. It was easy to hold the nose wheel off of the runway

Could be a full-scale Eagle on rollout. Model looks great from any angle.

for several seconds, looking like the Space Shuttle using aerodynamic braking to decelerate. When the nose wheel finally touched the runway, the oleo compressed giving a very scale-like nod to the nose as the shock was dampened. A round of applause from the corporate pilots and line boys, and it was over.

We filmed this early morning test flight on video tape, and I viewed the footage at least five times since returning from the airport. The tape reinforces my impressions: in sum, this is one hell of a scale airplane!

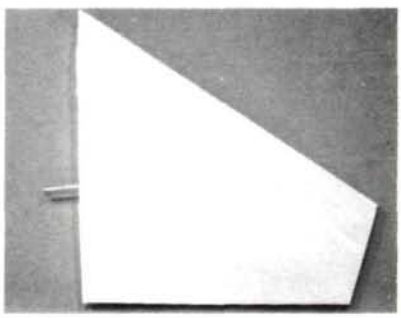
About four years ago at the W.R.A.M.S. show in New York, Bruce Godberson, of Byron Originals, asked me what I thought of the F-15 as a kit subject. The F-15, I replied, was one of those perfect subjects for a twin engined ducted-fan model. It has all the "right stuff":

1. Acres of wing area for reasonable wing loading, which means good stability and manageable landing speeds;
2. Near centerline thrust, which means that the loss of an engine does not require extreme corrective action; and
3. Large inlet and exhaust areas, which insure high installed thrust values for the ducted fan systems.

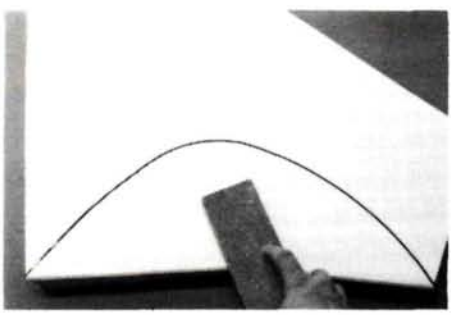
Two years later, at the Byron Fan Fly in Ida Grove, I got a chance to see the first F-15 prototype.

The factory demonstration team only had time for a few practice flights before the scheduled flying displays, but the model performed impressively and it confirmed the wisdom of selecting the F-15 for kit development. Several months later a second factory prototype was flown at the Southwest Fan Fly, and it was apparent to all present that the F-15 was being developed into a landmark design by the Byron factory (an excellent tape of this event is available from Video Specialties, Inc., P.O. Box 4557, Monroe, LA 71211-4557).

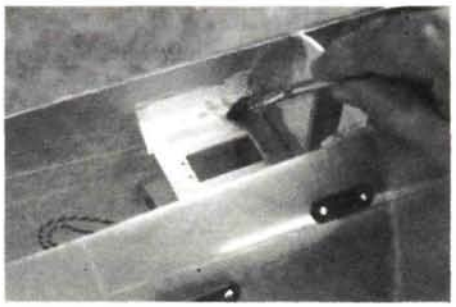
Not only did the F-15 establish a great "presence" on the ground by virtue of its size, it also proved its reliability by turning in numerous incident-free flights throughout the three-day event.



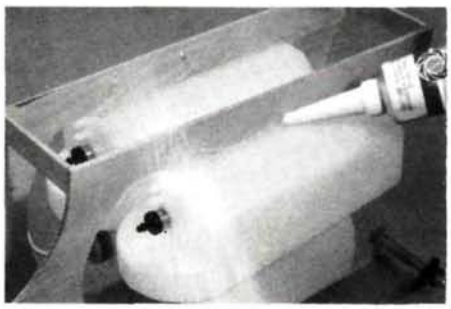
Above, wing panel awaiting final pieces of balsa sheeting.



Sanding foam cores to match trailing edge contour.

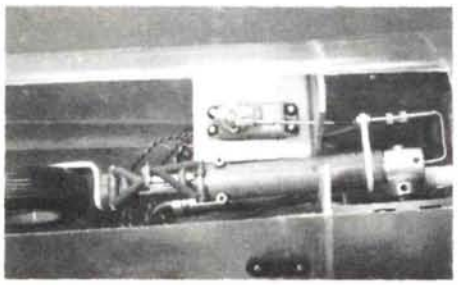


Installing servo tray with glass cloth and resin.

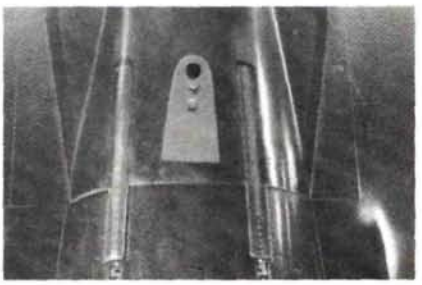


Multiple fuel tank installation being silicone-sealed in position.

THE KIT. I received the number five kit from the Byron factory in June of 1986. It arrived in three tremendous, well-packed cartons. The fuselage, which is lightweight fiberglass, was shipped in three sections. The flying surfaces, which



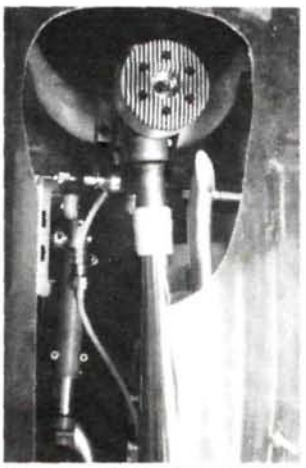
Nose gear retract installation shows servo position.



Speed brake area showing actuator attach points and molded channels for pivot arms.

are foam, were carefully protected against shipping damage. The canopy, which is formed from clear Lexan, is one of the most optically perfect model transparencies I have ever seen. Nothing hinders the appearance of a scale model more than a poorly formed canopy. The clarity of the Byron F-15 canopy is so good that I decided to add a fully detailed cockpit to my model.

The F-15, like all Byron kits, includes necessary hardware, fuel tanks, and special tools such as an awl and ball drivers. Highly detailed decal sheets are also included to provide authentic markings. One of the most important elements of this kit is a comprehensive owner's manual and detailed line drawings to insure accurate assembly.

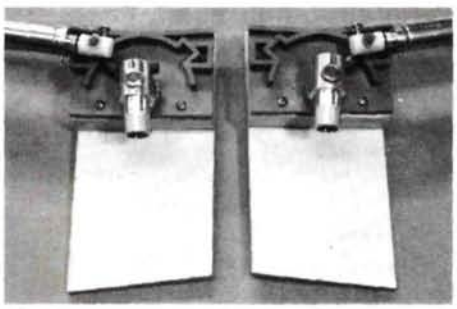


View through cheater hole shows Rossi .81, Byro-Jet, and main gear.

I spent several evenings reading the manual, studying the drawings, and examining the parts. It is always wise in a project of this magnitude to become mentally familiar with the building sequences to avoid painting yourself into a corner.

CONSTRUCTION. I followed the construction steps listed in the manual, and all progressed reasonably smoothly. I am a very slow builder, but I was astounded at how rapidly progress was made. I have no doubt that a diligent builder could have a reasonably well executed F-15 in the air within 90 days of the kit's arrival.

As building progressed, I became so impressed with the Eagle that I decided to incorporate as much scale detail as possible with a view toward using the model in competition. After all, several Byron kits, most notibly the Beechcraft

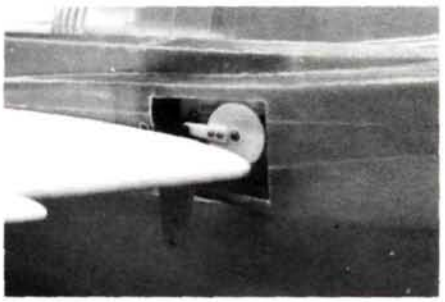


Main gear retract units are hefty and well-designed.

Staggewing and General Dynamics F-16, were scoring well in Master's competition. I chose to cover the flying surfaces with Dan Parson's .6-ounce fiberglass cloth and epoxy (avoid polyester as it will dissolve the foam). I molded fiberglass landing gear doors, and hinged the canopy so that it could be opened to display cockpit detail. Finally, I made fiberglass drop tanks and added panel lines to the flying surfaces (the fuselage already contains excellent surface detail from the factory molds). The additional weight of these details placed me well over the 28-pound weight of the factory demonstrators, but the appearance is well worth it. My model is now flying at a weight in excess of 32 pounds, but it handles the load with no noticeable deterioration in performance.

There are numerous excellent plastic scale models of the Eagle that provide a mountain of data on panel lines, cockpit detail, landing gear detail, markings, and three-dimensional shapes. The Revell 1/32-scale F-15C and E are masterpieces. I found them extremely useful in confirming scale information.

Unusual colors and markings of jet aircraft have always fascinated me. The first eleven F-15s were among the most highly colored Air Force jets in inventory when they were sent to Edward Air Force Base for evaluation in the early 1970s. These aircraft carried a highly visible paint scheme of Air Superiority Blue and Day Glow Orange. I elected to use these colors to insure good visibility of the model in all weather conditions. I have



Stabilator actuator linkage, very positive and slop-free.

seen several beautiful model jets lost due to pilot disorientation when they silhouetted against a grey sky.

As icing on the cake, the Byron factory offers several optional features with the kit. The retractable landing gear (this is a must, I can't conceive of building this model without these sturdy and realistic landing gear units), was developed from Byron's 1/5-scale fighter series. They give a very scale-like appearance and function perfectly. I have seen this land-

(Continued on page 110)

From The Cockpit

KEEPING THE KREMLIN AT BAY!

McDONNELL DOUGLAS F-15

by BUDD DAVISSON

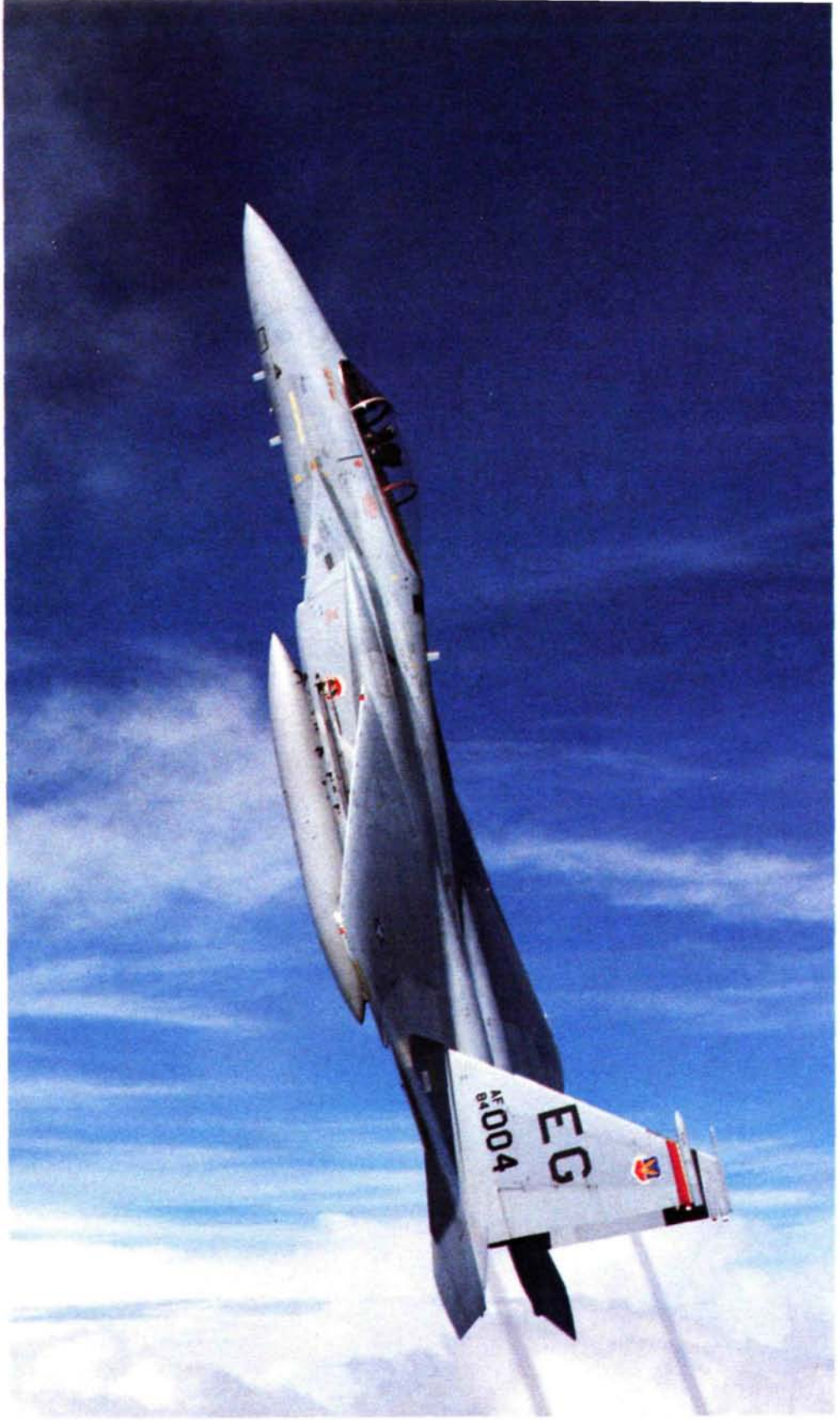
photos courtesy of McDONNELL DOUGLAS

NOT LONG AGO we did a piece on the F-14 Tomcat and its present role as glory boy in the *Top Gun* super fad. One of the facts which we mentioned with a tone of incredibility was that the F-14 first flew 15 years ago! This time we're talking about the Air Force's F-15 Eagle, and we're still incredulous that the Eagle, too, is over 15 years old! That means we have kids who've graduated from college, gone through Undergraduate Pilot Training (UPT), and are now flying an airplane that existed before they had conscious memory! A kid who was eight years old on the day the airplane first flew could be flying one of those twin-tailed blowtorches today! Now that's truly incredible!

The F-15 was born of the same need as the Tomcat. The Viet Nam experience had proven some serious flaws in our aeronautical thinking. Among other things, missiles weren't the final solution—a gunfighter still had to have guns in his holsters and most 'Nam era F-4 Phantoms hadn't any. Also, the concept of compromising the efficacy of the airplane in favor of dual missions, air interceptor and ground attack machine, didn't work. We had come to a point in aerial time when an airplane was either a fighter or it wasn't. If you wanted to hang bombs and rockets on it and point it at ground targets, that was okay, but an aircraft's primary mission had to be as interceptor/fighter.

So both the Tomcat and the Eagle were designed to be dog fighters for future generations. That's exactly what they've become.

While the reasons for their births were the same and their missions almost identical, the two airplanes part company on some very significant points. For one



thing, the Navy decided they needed two men on board, one to play with all the electronics and one to do the driving. The Air Force said no, they only needed a pilot with the right instrumentation to do their fighting.

The Navy, possibly because of their need to bring a plane on board ship at lower speeds, opted for a swing-wing setup which gave them variable sweep and made both ends of their flight envelope impressive. The Air Force went the "hard wing" route—what you see is what you get.

Exactly how the airplanes stack up against each other in a "hot gun" situation is a subject of heated controversy. The pilots of both airplanes are convinced they have the best ships in the world and both airplanes are undergoing extensive fleet modifications to make their electronics absolutely unmatched anywhere. In fact, the new F-15E has so many new gadgets, they've seen fit to putting a second man in back to play with them.

As originally issued to the squadrons in 1974, the F-15 was a single-seat, pure fighter that still grossed out at 56,000 pounds. In the "E" model, that figure has grown to 81,000 pounds. That's impressive when you figure a B-17 Flying Fortress weighed only 49,280 pounds fully loaded. What's even more impressive is that the airplane has maintained a power-to-weight ratio that's easily better than 1:1, which means it can sit on that column of flame and accelerate out of sight going straight up.

The performance figures don't even seem real, and it must be assumed that if we civilian rag legs know these numbers, the actual performance is probably even better. For one thing, it's capable of sustained (or until the fuel runs out) speeds of Mach 2.5, unfortunately it's burning around 417 gallons a minute at low altitude. Just loping along at 430 knots at 43,000 feet or so, it sips a miserly 10.6 gallons per minute.

With only internal fuel (no drop tanks) and normal ordnance load, this thing will show an initial rate of climb of 50,000 feet per minute while a Mustang does only about 2,500. In other words, an F-15 Eagle can initially climb at the equivalent of going 568 miles per hour straight up!

The earlier models had pretty short legs and were only good

Model Airplane News
McDonnell Douglas
F-15 EAGLE

photo courtesy of McDONNELL DOUGLAS

for about 90 minutes without carrying external tanks or doing some aerial refueling. The later models have "conformal" fuel tanks that hug the fuselage and generate almost no extra drag. In that configuration they can do over five hours non-stop. Of course if they snuggle up to a tanker in-flight, their endurance is determined by the stoicism of the pilot...they've flown as long as 15 hours!

At full-up gross the airplanes weigh around 56,000 pounds (42,000 pounds as an interceptor) which gives them a wing loading between 60 and 90 pounds per square-foot of wing area. That approximates the loading of a man-hole cover being used as a frisby.

The F-15 was designed before the concept of computer-controlled, fly-by-wire airplanes came along. In all new generation fighters such as the F-16 and the A/F-18, the pilot isn't really flying the airplane. He has a joy stick controller that's actually doing nothing more than talking to a computer. The computer is flying the airplane. With the computer between him and the airplane, everything the pilot tries to tell the airplane is interpreted and changed via the computer's software programming. If the computer senses the pilot is pulling too hard, it will soften the pull. It will always protect the airplane from the pilot and keep the machine within its design envelope.

Not so with the F-15. The Eagle driver retains his autonomy and if he's man enough, he can bend the airplane (9 Gs!). More important, he can skate around at the edge of the envelope and, if necessary, do things the airplane isn't really designed to do. And for generations of fighter pilots, the ability to do both the unexpected and, at times, the illogical has often spelled the difference between painting a flag on your fuselage or becoming one on the enemies. Computers usually have too much common sense to be good fighter pilots.

However, computers definitely have their place in an age of missiles, so do super-sophisticated avionics and electronics equipment. Everything about the black boxes on the Eagle has been designed for some serious butt kicking from the very beginning. The gimbal-mounted Hughes APG-63/70 X-Band Pulse Doppler radar has eight to ten times the search ability of earlier units, and has tremendous lock and search angles which allow the pilot to fire accurately during rapid roll and pull maneuvers which are part of aerial combat.

The APG-70 radar is really spooky stuff! From more than 80 miles out at low altitudes, the crew can pick out bridges and airfields on the radar display. As they get closer, th resolution gets even better and they can pick out vehicles!

One of the really neat things about the radar is its "hide mode. Since searching targets with radar gives the enemy warning because of the incoming radar signals, the Eagle ha a way of freezing the display in a quick sweep and the shutting it off. That way, the pilot knows where he's going bu the bad guys don't. If they did happen to detect his signal, the won't know where he is by tracking his own radar emissions.

The "E" models are meant more as tactical strike aircra than pure interceptors. Designed as a dual-role airplane, the are supposedly going to replace the F-111s as a long-rang tactical bird. That's why they have the conformal tanks an the electronics operator. The "E" weighs an incredible 81,00 pounds, and reportedly can pull 9 Gs with 6,000 pounds o

(Continued on page 93)

BYRON ORIGINALS

A product of Midwest Industries, Inc. Ida Grove, Iowa. 51445 Ph. 712-364-3165

From Jugs to Jets . . .

NEWS FLASH! Byron Staggerwing Earns TOP STATIC Score at 1986 Scale Masters!

Not shown: Glasair TD, MiG-15, Pitts, Eagle, CAP 21, F-20, Beech Baron, Pipe Dream Trainer, Bonanzas, Kfir C-2.

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CONTROL TOWER

(Continued from page 14)

Now back to the transmitter. At the upper left front, we have the elevator dual-rate switch where up is On, next the elevator-flap mixing switch where On is down. Next is the Channel 6 flap trim knob and this control is calibrated and detented. Moving right we have the meter which indicates battery condition and output power with one needle. When the needle moves from the white to the red zone, it's time to bring your aircraft down and recharge the batteries. Moving to the right you find the Channel 7 spoiler control which is also calibrated and detented. Next is the flap/spoiler-elevator mixer switch, down is On. Moving on to the right, we have the aileron dual-rate switch. The lower position is Off and above two positions 1 and 2 allow two rate positions to be set up on the rear trimmer panel to your individual taste.

Moving to the transmitter center left we have the left stick, which in the Mode II configuration has throttle and rudder with their associated electrical trim controls. The throttle is detented and moves forward and backward. The spring-loaded rudder control movement is left and right.

Let's skip over to the right stick (elevator and ailerons) which is spring-loaded for hands-off neutral. Electronic trims are in the appropriate positions. All stick trims are detented. In the center of the transmitter below the level meter we have two mixing and one snap roll indicator. When those controls are activated, the indicators will blink. Below that we have the neck strap hook and the power On/Off switch which must be pulled forward and pushed up to turn on the transmitter. The red power lamp below the meter will glow red.

At the bottom of the front panel we have the Tachometer/Timer indicator. Using a Liquid Crystal Display (LCD) it provides the ability to read engine rpm via an accessory tachometer sensor and cable powered by the transmitter battery. The display can also serve as an elapsed timer for competition flying. These features are not available in any other radio system that I'm aware of that is available in the U.S.

On the left top side of the transmitter there is the idle-up lever which controls engine idle during throttle-pitch control mixing if you use a controllable-pitch prop. On the transmitter right side at the top we have the prop pitch control (Channel 8) trim lever. At the bottom right side, protected by a molded rubber cover, are the connections for the tach sensor cable and below that the charger and direct servo control receptacle. Both use the same receptacle, but of course not simultaneously.

Moving to the rear of the transmitter on the left upper side is the snap roll direction slide action switch, right or left. In the center of the transmitter back is the frequency module. It can be removed simply by pressing two spring-loaded clips and pulling it out. But remember, if you change frequency within the 72 MHz band, you must change both transmitter and receiver crystals. To the right of the frequency module are the fail-safe set button and another snap roll direction switch which allows the aircraft to be snapped in a climb or a dive attitude.

Finally, we arrive at the lower transmitter back. Remove the plastic panel and you'll discover 60 controls, including pots, switches, and patch panels. It would all be a little mind-boggling if it weren't

(Continued on page 74)

CONTROL TOWER

(Continued from page 72)

for one of the most comprehensive instruction manuals I've come across. It includes 40 pages of text with great illustrated line drawings, exploded views, and isometric drawings. The manual is actually a small book. I had only one problem, the transmitter isometric, which I've used in this article, shows a Mode I stick arrangement, namely rudder and elevator on the left stick and aileron and motor on the right stick. I described in this review a Mode II stick configuration which is what I received and I believe all U.S. Futaba FP-8SGAP radios are being delivered with the Mode II stick configuration, unless Mode I is specifically requested. The instruction manual also covers in detail how the simple conversion is made from Mode II to I and vice versa.

The Futaba FP-8SGAP is a very sophisticated radio and it will take a little work to get to know it, but it's worth the time if you want to be a serious R/C flier. Joining a local R/C club is a great way to get started and get help with your flying. Remember, you can start flying this Futaba on four channels and grow with it. I'm presently flying the single-stick version and its precision is remarkable.

Charlie Kenney, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in this article:*

Futaba Corporation of America, 555 West Victoria St., Compton, CA 90220. ■

CHECKMATE

(Continued from page 48)

know what to do when construction begins.

The wings are standard foam cores of symmetrical airfoil. Sheeting in the kit is provided to sheet the wings. We joined our sheeting with Hot Stuff Super T (from Satellite City*) and then sanded the sheeting smooth. The completed wing sheeting was then applied to the cores with Hobby Poxy* and allowed to cure overnight. We used a single 1-inch-wide strip of carbon-fiber cloth matte between the sheeting and the cores for reinforcement; but this is a personal preference, not a requirement. The stock method as described in the kit is fine.

After sheeting, the wings were finished with joining, retract cutouts and wing tips. The whole wing was sanded and the center joint reinforced with 6-ounce glass cloth from the kit.

The ailerons on the Checkmate are barn-door types, being actuated from individual servos mounted on the wing. The aileron itself is cut from the wing and the raw foam that is exposed is to be covered with the kit-furnished 1/16-inch balsa. The kit calls it foam caps, but believe me, there is no foam to cap the surface with; use the balsa. Addition of the aileron leading edge finished the ailerons.

At the tail section, there's another foam core for the horizontal stab. Again, sheeting was applied using 45-minute epoxy cured overnight. Like the wing, the elevators are cut from the trailing edge of the covered stab. Add wing tips and leading edge materials and you finish by sanding the whole thing. The plans tell you to taper the elevators carefully to the trailing edges to maintain a good airfoil shape. The elevators are large, so heed the instructions.

At the vertical stab there's a ribbed structure inside of balsa sheeting. The vertical stab is quite thick, even after one

shapes the assembly to contour. It goes together in a snap, the sanding taking more time than the assembly. Completion requires the mating and matching of the balsa rudder. As in the elevators, sand the rudder to match the stab contour and airfoil.

The tough part comes next—the fuselage. In the interest of simplicity, the basic fuselage is slab-sided with common doublers up front. The kit supplies hardwood engine bearers, already machine-cut to about the right thrust setting. You'll have the option to use a four-stroke engine. The engine compartment and firewall need to be spaced according to your engine choice. We chose a two-stroke O.S. Max .61 RF Long Stroke from Great Planes Model Distributors*.

For the most part, this finishes the airframe construction. The rest is sanding and shaping to conform to plans. The last installation on the airframe is the canopy, which we did after the first primer coat.

A majority of the airframe construction was performed using Hot Stuff and Super T adhesive. All joints are quite strong enough to withstand the rigors of pattern life. Finishing off the airframe was done using Silkspun Coverite, ironed on the fuselage and tail feathers, and then shot with K & B* Super Poxy Primer. This was then sanded smooth, a second and third coat applied, sanded and filled, and then color-coated with Superpoxy. The wings were covered with Top Flite Super Monokote film. This kept the wing light, very important in Turnaround.

The radio we used is the best from Airtronics, the Module 7P seven-channel pattern radio. This radio features clean FM transmission, dual-rate elevator and aileron, reversing on all channels, end point adjustments, total throw adjustment on throttle, and a snap-roll switch. Other features include mixing of the flaps to elevator, timer, warning lamps for dual rate and snap-roll functions, removable battery module, and interchangeable frequency modules. It's a handful of radio.

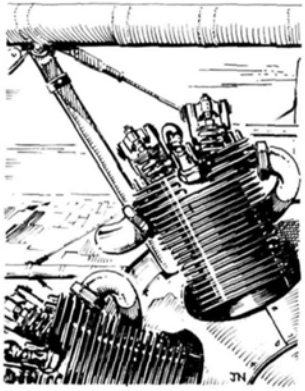
The module 7P receiver is quite small, easily fitting into the shallow fuselage of the Checkmate. The servos were the Airtronics 94551 ball bearing and coreless motor servos. Just the ticket for pattern flying. A 94553 retract servo handled the landing gear chores for us. Performance of the 7P radio has been outstanding with over 50 hours of service as of this writing.

The engine powering our Checkmate is the latest powerhouse from O.S. Max. This motor should have come out a long time ago, as it really is a Hercules motor. It is no bigger than the previous FSR series of motors, save for the newer two-needle carb, but the difference in power is great. That little bit longer stroke makes for a torque curve that is off the dial in vertical performance. Set with a 14.5-inch pipe length and a 12x9 prop, the top rpm was conservative at 11, 500 rpm—but don't forget, we want torque, not revs, for Turnaround.

Our finished bird tipped the scales at about 8.5 pounds dry, and all dimensions were accurate to the specifications. We used a tail dragger configuration in lieu of a traditional trike gear because we didn't want to put up with the crammed quarters of the nose section once the header pipe ran through it. The tank is a Sullivan* 16-ounce slft slant tank. Retracts by OK/Hobby Shack*.

FLYING. In the tail-dragger version, the Checkmate taxis very nicely, deliberate in direction. This continued right through to launch, requiring little rudder correction for takeoff. The Checkmate rises rather slowly from the deck, almost disappointing you with her speed. But this

(Continued on page 77)



Four-Cycle Forum

by ELOY MAREZ

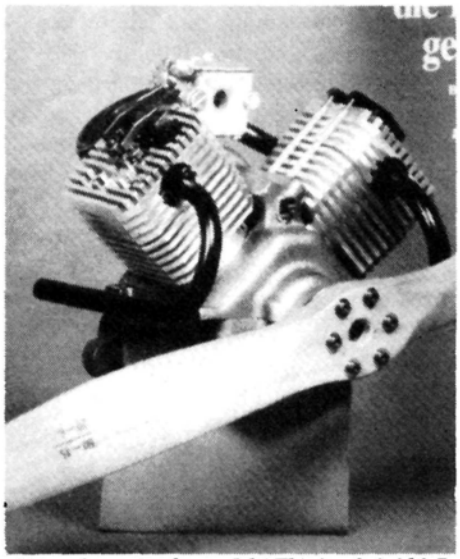
NUREMBERG, WEST GERMANY. That's where I went to gather the information you'll be reading about this month. Now you might not think it was much of a sacrifice, but consider that on my way to Los Angeles Airport I had my car's air conditioner on. The very next day I'm all bundled up with long underwear, gloves, and a lined topcoat. I was there the first part of February, for the 38th International Toy and Hobby Fair, and I'd like to share with you some of the interesting things I saw.

The ST-540 is first on the list. This is the four-cycle, five-cylinder, glowplug ignition radial engine which I told you about earlier this year. As I explained then, the information was third-hand by the time it got to me, but it was all I had, and I thought that it was interesting enough to pass on. I'm glad to say that I now have first-hand information—I was fortunate to meet the designer and manufacturer of the engine, Wolfgang Seidel*, of Ettlingen, West Germany. It was a very interesting meeting. Mr. Seidel recognized my name tag and things got even more interesting, as he does not speak English and my German is limited, to say the least. Anyway, the charming Mrs. Seidel came to the rescue, her translation providing the necessary communications link.

The Cipolla 120 4T-TSV has twin shaft valves similar to HB and Webra.

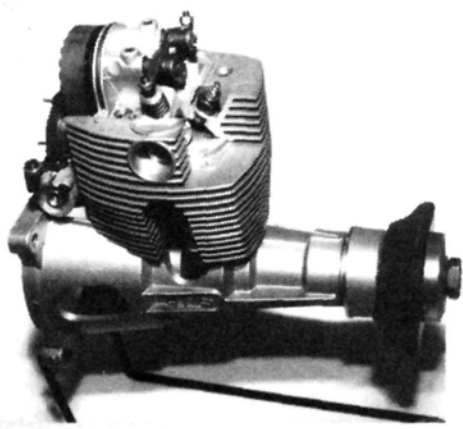
First, the name: ST stands for Sternmotor; 5 is for 5 cylinders, and 40 for the displacement. In cubic centimeters, of course. Each cylinder is 8cc, which calculates to 2.44 in cubic inches.

The bore and stroke are .8858 and .7795 respectively. Maximum power is stated as 2.8 horsepower. Speed range is from 1,100 to 6,800 rpm. The weight of the engine including engine mount is 3.97 pounds, and its external diameter is 200 mm—I mean, 7.87 inches. Recommended props range from 18x8 to 22x6, and the recommended glowplug that's available in the U.S. is the Enya No. 3.



A Porsche engine for models! This is a 2.4 cid 2.7 hp mill. See text.

The ST-540 is assembled similarly to a full-size engine, with the cylinders and cylinder heads being screwed together and tightened to established torque figures. The centrally-located rear-mounted carburetor feeds the mixture directly into the crankcase, from which individual manifolds feed each cylinder head. According to the designer, the rotating crank-drive helps to optimize the fuel mixture and also provides inner cooling and constant internal oiling.



Single overhead camshaft is an unusual feature of the OPS 20 40HC.

I've seen the ST-540, and I can tell you it's an extremely well made engine. Its construction involves not only a lot of different technologies, but also a lot of pride. I believe that the closing statement in its advertising brochure says a lot about the philosophy of the designer. It states, "The exposed valve gear not only makes adjustment easier, but it would be unforgivable to deprive the onlooker of the pleasure of its rhythmic movement."

Not intended for paperweight duties by any means, I have copies of a German publication which describes and illustrates a sixth-scale Junkers JU-52, powered by ST-540s. In case your aviation history fails you, it was a tri-motor, way ahead of its time and a low-winger. Imagine the sound of fifteen four-stroke cylinders on a low pass?

Wie viel? How much? As of this writing in early March, the price in Germany is 2,800 German Marks. That's about $1,500. The exchange varies, as you probably know. The exact dollar amount can be obtained from any large bank. You also should consider postage and customs duties which may be imposed.

For further information please contact Wolfgang Seidel directly at the address given at the end of this column. Remember, Air Mail letter postage to Germany is 44 cents. *(Continued on page 88)*

CHECKMATE

(Continued from page 75)

soon makes way for her real speed as the O.S. unloads in the air and the Checkmate starts to cook.

Once the firewall is placed, the regular formers are placed in the fuselage sides and the two sides are mated permanently. Top decking is next, setting the stage for the main turtle deck.

The turtle deck area is a tricky one. Formers are installed to maintain the curvature of the turtle deck before sheeting. But when gluing the sheeting to the formers, take good care to pre-stress the sheeting. We stressed ours by wetting the wood completely and allowing the wood to dry around a cylinder with about the same radious. If you don't do this, you may end up with a slight bow between the formers.

Once the sheeting is installed, the upper cap sheet of ¼-inch soft balsa is glued down. You begin the shaping and sanding from here; be careful, though, as the wood will get pretty thin at the top of the fuse if you get real enthusiastic on the sandpaper, as we did, ending up with another layer of balsa sheeting installed to correct it. Once completed, the cockpit and forward fuselage are formed and sanded to shape.

The tail feathers are mated up to the fuselage. Take special care to align the feathers straight, lest you want to fly a crooked bird. It will also help if you mate the wing up to insure overall alignment. Once satisfied with the fit, glue the tail feathers in place with epoxy and then make fillets to make everything look good and smooth.

The wing is held in place with two arrow shaft stubs at the front of the wing and two .25-20 nylon bolts at the rear. For once, someone in kit land was thinking when they used arrow shafts for wing hold-downs at the front.

Next is the engine and exhaust system installation. For the four-stroke fans, an extra firewall is installed between F-1 and F-2 to stop hot gasses from invading anywhere beyond the firewall. For the two-stroke, cut out the firewall and wing in order to clear the pipe and header. As it turned out for us, the wing did need a little cutting in order to clear the pipe. We cut with surgical precision, using a Moto-tool with reamer bit, and then filled the void with a layer of 6-ounce cloth and carbon-fiber strands. The instructions call for lining any cutout with the furnished plywood and cloth.

Once the wing and forward fuselage are cut to fit the engine and exhaust

Golden Age of

by HAL "PAPPY" deBOLT

IF CORRESPONDENCE is any indication, then there's plenty of interest in building and flying OT R/C. A typical question involves finding plans. I recently mentioned that Midwest Products* had produced some kits for the Super Esquire. This brought an interesting reply from OT R/Cer Tom Ailes of Valpariso, Indiana.

Tom tells me that the Super was designed and built by Doug Mauer of Hobart, Indiana, in 1957. It was powered by a Fox .35, used Babcock single-channel escapement equipment, and was flown widely. Its demise typically came about when the escapement "stuck," and it spiraled down into a road. What's really amazing is that Robert White of Valpariso, still has the pieces after all these years!

Tom also mentioned that he has a Giant Esquire built for rudder-only back in 1959. The wingspan is 96 inches with a 20-inch chord, powered by a .60. Presently, Tom's flying a vintage Smog Hog, also built in 1959. I recently described the Hog as an ideal OT R/C for sport flying. Tom closed by saying that folks don't know what they're missing if they haven't tried OT R/C.

As for locating plans, the March '87 issue of *M.A.N.* included a plans catalog. Inside I found three popular OTers, the Buccaneer, Rudder Bug, and a Mini Smog Hog. I know that in its 50-plus years *M.A.N.* has published most of the outstanding R/C designs. For a complete listing of all *M.A.N.* plans, send $2.00 to Air Age, Inc., 632 Danbury Rd., Wilton, CT 06897.

I also reviewed a *Model Builder* plans catalog, and was amazed to find at least a dozen goodies inside. How 'bout Good's Guff, Schneider's Cub, Lanzo's '37 Nats winner, and the Trixter Beam to whet your appetite? I've mentioned other sources in the past, including Frank Zaic's* books for a gold mine of outstanding designs.

Awhile back, I described the original Live Wire as the "Senior," saying that it was kitted in very small quantity. The first kit went to Leon Shulman, and the second

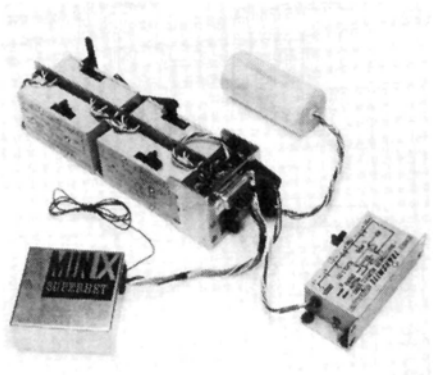
An interesting group of R/C pioneers includes (l to r) Colby Evett, Mel Davis, Ken Willard, Mel Farrell, Bill Glitch (what an R/C name!), and Bob Palmer.

to Harvey Thomasian of Northboro, Massachusetts; that was in 1953. Now, I'm happy to show you a photo of Harvey's Senior, still flying 34 years later! It's gone through several engines and radios, but Harvey just loves to show the current generation what early R/C was all about.

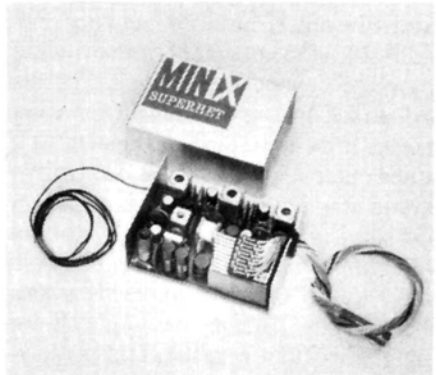
I should tie up the loose ends left dangling from our technical discussion of reed systems. Descriptions of the Rockwood, Schmidt, and Bramco systems covered some of the details. However, the woods were full of other brands during this period of intense development. Many fell by the wayside, but a few went on to be leaders for many years to come. Brands like C-S, C-G, Min-X, Kraft, and Orbit come to mind as popular choices of the day. While these companies produced fine equipment, none of their reed efforts were especially unique or unusual. I'd appreciate any further input/information from you folks.

Reed systems experienced a second phase of technology which vastly improved them. It was brought about by the invention which has set the world on fire, the transistor.

Today, it's hard to believe that these little electronic chips didn't exist just 30



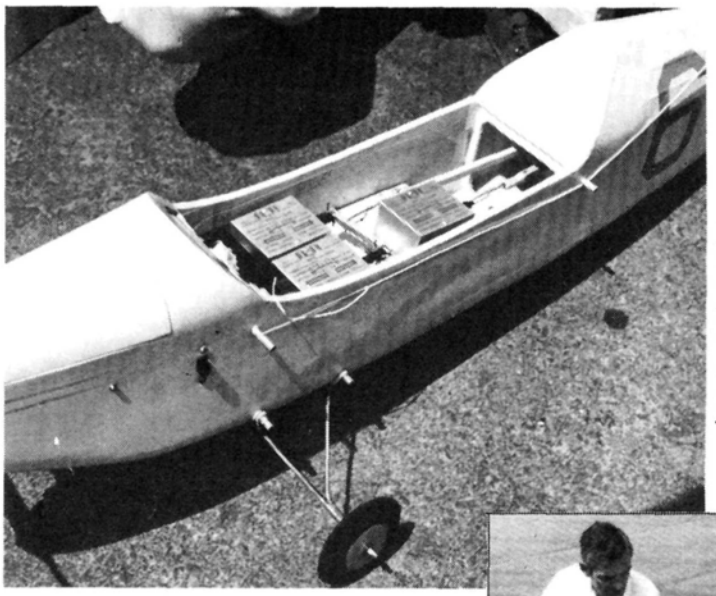
Min-X "brick"-style reed airborne system with Bonner Transmite servos.



Min-X superheterodyne relay-less receiver was typical of the ultimate reed receivers.

years ago. This new kid on the block led to the demise of reed systems by making proportional a reality.

If you're not electronically oriented, then it's hard to imagine the uncertainty which this creation caused. My own indoctrination came when I walked into Frank Schmidt's shop one afternoon.



Left: Keith Storey's Nats-winning Pylon racer of 1954. Note bulky Bonner servos. Below: Tom McCoy and Harvey Thomasian with Harve's everlasting L.W. Senior; 34 years old.

Frank, busy at his bench, suddenly turned to me with an ear-to-ear grin. He asked me to wait while he observed his test instruments. Then he pointed to a small, shiny metal capsule in the middle of the test board maze of capacitors and resistors, "See that?" You could tell by his voice he was excited. He said the little capsule had cost him $74, and that it was going to revolutionize electronics and eventually R/C.

I listened to the space-age description of just what it was and how wonderful and all. And I couldn't believe it at first. I couldn't believe that such a little gimmick was capable of replacing most of the major electronic components, the tubes, transformers, and relay switches. If this was true (how many times have you been led astray by preposterous claims?) even my limited knowledge could foresee R/C weight flying right out the window. The only drawback was the cost ($74 for the equivalent of one tube?). But with its tremendous advantages and far-reaching applications, it wouldn't take very long for the industry to find an answer. How right I was, because in no time a similar transistor could be had for only 28¢.

The immediate impact of the transistor upon R/C ocurred with the reed systems. The transistor circuits switching ability was neatly adapted to replace the maintenance-prone, heavy relays. These initial transistors were not sensitive enough to be used as high frequency detectors, so the receiver still had one small tube. Since only small modules replaced three large tubes, sockets, and relays, the reduction in bulk and weight was substantial. Add to this the considerable reduction of required batteries, and there's a dramatic improvement in both weight and operating cost. What's less apparent is the considerable increase in reliability. Actually, these reed receivers without relays were the first step toward digital proportional and allowed for development and testing of the first stages. Later on, the reed bank was replaced with transistor discriminators.

Speaking of initial stages, the capabilities of transistors improved rapidly, allowing R/C to take advantage of the much desired circuit. Broadcast radio had shown the way with the conversion from "super regenerative" to the three-stage "superheterodyne" circuit. This eliminated much of the static which plagued early radio. Basically, the superheterodyne simply changes the incoming signal frequency, which gets rid of most of the unwanted noise in the original signal while amplifying the new frequency. Transistors simply made the addition of the necessary three stages practicable. It can be said that the superheterodyne which didn't use relays became the ultimate in reed receivers.

These last reed systems also initiated proportional-style servos. Remember all the switches involved in the original reed servos? These were replaced with transistor amplifiers, eliminating servo switch maintenance also. Overall, the transistor created a very reliable reed system, a giant step toward today's technology.

I'd be remiss if I didn't mention one final improvement, even though it came too late for widespread use. A major flaw inherent to the reed systems was the lack of simultaneous control. Any reed system could respond to two simultaneous tones, however only with the minimum reed bank power which required wide separation of tones. This just wasn't practical. Bramco's highly efficient reed bank improved it by reducing the tone separation and reed response band dramatically. With this change and careful contact adjustments, two adjacent reeds could be reliably commanded at one time. Now we could finally have ailerons or rudder with elevator!

With both simultaneous ability and the superheterodyne we glimpsed the finest reed systems. These were available in

(Continued on page 91)

Pattern Matters

by MIKE LEE

Craig Hath, M.A.N.'s helicopter author, walks out a Sig Kouger 40 for his pilot. Even helicopter jockeys like "hot dog" ships.

THIS MONTH I'd like to dedicate some time to the real foundation of the pattern jockeys, the sport pilots. At the inception of this column, some 3½ years ago, I said that it would be a forum for sport and pattern pilots. I've said a lot about the pattern guys, but not enough about the sport people.

The reason why I mention this is because many sport-minded pilots have asked me to suggest a good sport low-winger that isn't as stable as the run-of-the-mill sport/trainer low-winger, isn't quite the pure pattern bird, and is a good hot-dogging machine. That's not a tough bill to fill when you consider that what they're looking for is already available.

First off, this type of pilot isn't looking for a pattern bird, although he likes their smooth aerobatic capability, because he realizes that the bird is almost too smooth to really wring-out. And he doesn't really want to dedicate his flying time to daily practice of the same regimented maneuvers. He wants to "hot-dog" around the sky and have fun. Not that pattern isn't fun, as long as you're willing to put in the time and practice combined with a correctly-built bird. But hot-dogging is both teeth-gritting fun and exciting to watch. And pilots love to be watched, especially when they're enjoying the show even more than the spectators. Hence, the need for a sport ship that can do it all and then some—without costing $500!

Off the top of my head, I can recommend the following ships which are a lot of fun and which can take abuse. All are low-wing designs. I picked the low-wing ships because they're capable of the point and knife-edge maneuvers that are so impressive. They are as follows: the Great Planes* Sportster (all three sizes), Airtronics* New Era 40, GM Precision Products* Sunbird, any Quickee 500-type plane, the Sig* Kougar, Bridi* Kaos 40, Balsa USA* Smoothie, and Craft-Air* Firebird.

That's quite a list of good-flying planes. Most have excellent qualities which allow even low-hour pilots to become comfortable with them in a very short time, but which also allow the experienced pilot to manhandle them. Note that all are .40-size ships, because the .40-size engine is by far the most popular in the hobby. Each can be entered into pattern competition in the lower two classes of AMA pattern, and would be competitive. Now that we have a starting point on a good hot-dogging plane (there are certainly more than those mentioned), we can take a look at how to make one work for you.

Like pattern birds, sport ships must be built straight. Crooked ones crab on landing—without a crosswind! Second, they must be properly powered to perform the desired stunts. Underpowered ships are all right for loafing around the sky, but can't do much hot-dogging. And third, they must be trimmed-out in flight just like a pattern bird. It should fly pretty much hands-off in straight-and-level flight.

The building stage is really up to you. We've all heard that in order to build straight, you need a good building surface, basic tools to insure alignment, and both know-how and patience to do a good job. Basically, following the instructions will take you a long way toward making a straight bird.

In the power department, the aircraft which I've recommended all fly very well

Rick Mattie brings back his father's EZ Cherokee from an official flight.

with .40-size engines. Whether the motor is a standard cross-flow-scavenged-type design, or a Schnuerle-type port design doesn't matter a whole lot. However, the added power of the Schnuerle-ported engines is well appreciated. Whatever you do, have foresight in placing the maximum amount of power (within reason) on the nose of the plane. You can always throttle down, but once at full throttle, it ain't going to go any farther.

Trimming the ship is the last step, and it's where we've got to do our homework. Provided that the bird is built straight and there's adequate power up front, we head to the flying field to trim out for performance flying. Tune the engine correctly, even a tad rich, and put her up in the air.

Once airborne, trim the ship for straight-and-level flight with the ailerons and elevator. If the ship is straight, trimming should occur easily and quickly. Feel-out the flying characteristics and get comfortable with her for a minute, then let her go out to the end of the flying site and return on a straight-and-level flight path back in.

On this pass, ease the ship into a loop. *Ease* her into the loop, don't jerk the stick. The ship should arc upward gracefully on a straight-and-level loop track. Note any deviation to the left or right. If the ship begins to track left or right, then the rudder trim is off.

To adjust the rudder trim, continue performing the large loop while trimming the rudder to eliminate any left or right deviation. If she goes left, trim right. Keep doing this until the ship can be eased into a loop and maintain the level and straight path upward. If you have achieved this, then you can haul back on the stick. The reaction to the pull-up should be the same as in the loop, a straight path upward.

Once the rudder is trimmed out, it's time to see if there's enough control throw to satisfy the thirst for hot-dogging. Normally, a rather rapid roll rate is desirable, it's up to you to decide. Too fast will get you into trouble quickly, perhaps necessitating another trip to the hobby shop to replace a plane. The roll should be fast enough so that you can recognize the roll rate and be able to stop the ship at any angle you want.

The pitch rate should be such that the aircraft is comfortable to feel on the sticks. Too fast of an elevator will make the ship appear to "porpoise" in the air while you attempt to find the correct heading. Not enough will cause you to run out of elevator—usually at the most inopportune moment. The rate should be set according to your own feel for the sticks.

Since most pilots who progress past the beginner stages have already purchased their second or third radio, it's normal for them to have radios with dual rates. Here's where you can get the best of both worlds in control deflections. I like to set my high rates so that the ship is pretty touchy to the sticks and will fast roll or square loop with a quick flick of the sticks. The low rates are set at more comfortable rates so that I can easily land the bird without over-controlling or porpoising. Some pilots like a normal high rate and a very subtle low rate. Whatever the choice, make good use of these features for maximum enjoyment.

Now for the maneuvers themselves, and how the control surface throws should be. I mentioned the roll rates before, as well as the elevator rates. Now for the really fun surface, the rudder.

The rudder has a lot to do with hot-dog stunts. Without it, stall turns, barrel rolls, snap-rolls, and spins are impossible. Point rolls become quite sloppy (not to mention very short) while slow rolls have a large arc to them. The rudder plays a major part in the stunts, yet is the most neglected surface.

Since the rudder is already trimmed you need to find out if there's enough rudder for the maneuvers you want to perform. Once the ship is airborne, do a simple maneuver, like a stall turn. Pull the ship straight up into a climb, make sure the ship is absolutely straight-up vertical, and then cut the power. As the ship loses forward motion, lean on the rudder with full-throw. It doesn't matter which direction if you are straight up, but take care to feed-in gradual but firm rudder input; don't jab it in.

The plane should now pivot about the wing tip on a nice stall turn, with a trajectory going straight down, the tail wagging a bit. This is a true stall turn. If you don't have sufficient rudder throw, the ship won't pivot around smoothly, normally doing a forward or rearward flop. If this happens, more rudder throw is required. If the ship darn near flipped into a cartwheel at the top, then a bit too much throw is present, and the rudder needs to be toned down a bit. Adjust the rudder until the stall turn is looking right.

From here, you should be able to perform all the other stunts with no problem. Snap rolls at both slow and high speed should be possible. Spins from a full stall should occur almost immediately as the ship falls. And point rolls should be

A pilot checks out the competition as he prepares his GP Sportster.

quite easily handled with long points possible. Even extended knife-edge flight is possible with proper rudder throw; it pays to put a little attention into the rudder.

So here's the recipe for a hot-dog flier: a .40-size plane with low-wing design, plenty of poop, a four-channel radio with dual rates if possible, and a properly trimmed ship. This is what fun's all about guys. This type of ship is the backbone of flying enjoyment, because of its versatility. Not only is it good at hot-dogging around the skies, but it's also deadly at fun-fly events, and can take the daily abuse of a dozen flights per session.

Certainly, there are other recipes for a fun day aircraft, of different sizes and designs. But there's no beating a ship that does it all, including competition. When you're ready to have some fun, even if you're a master pilot, try a hot-dogging session; it's what flying's all about. On that note, we're on the pipe and airborne.

Mike Lee, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the manufacturers mentioned in this article:*

Great Planes Model Dist. Co., P.O. Box 4021, Champaign, IL 61820.

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CHECKMATE

system, the lower fiberglass belly-pan is installed. This unit will stretch from the spinner ring to the trailing edge of the wing. The proper way to install this jewel is as follows.

Install the wing to the fuselage and tighten as you would for flying. Next, place the belly-pan on the nose and tape to position from the F-2 former outward. On the wing, carefully place the balsa belly-pan formers so that they align under the belly-pan. Once satisfied, glue in position and allow to dry. Dismount the belly-pan and install alignment pins in the belly-pan to finish mounting. Done.

Checkmate is no slug with this engine/pipe setup. She's clean and accurate, accelerating quickly yet smoothly. My particular flying style favors the snappy aircraft, but with the Checkmate, smoothness is the style. She enters and exits the roll nicely, almost like being slipped into the roll rather than hitting it. Pitch maneuvering is also nice, producing good looping capabilities while still having enough to pull the square corners. Rudder input must be firm or nothing will happen for awhile. This is particularly true in point and slow roll maneuvers. It is, however, sufficient for the stall turns.

Landing the Checkmate is a bit unusual: this bird is so clean she'll maintain her airspeed for a long time and then stretch out in the ground effect. The result is that you must drag her in with the gear down from a long way out, and she'll reward you with any type of touchdown that you want.

**The following are the addresses of the companies mentioned in this article:*

Craft-Air, 6860 Canby Ave., #120, Reseda, CA 91355.

Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

Satellite City, P.O. Box 836, Simi, CA 93062.

Hobby Poxy Products, 20 Pine St., Rockaway, NJ 07866.

K & B Manufacturing, 12152 Woodruff Ave., Downey, CA 90241.

Airtronics Inc., 11 Autry, Irvine, CA 92718.

Sullivan Products, 1 North Haven St., Baltimore, MD 21224.

Hobby Shack, 18480 Bandilier Circle, Fountain Valley, CA 92728. ■

FOUR-CYCLE

(Continued from page 76)

We all expect different things from magazines, but I would venture to guess that more than anything else, we're looking for something completely new. It's not often that you can find it to read about, and those of us on the other side less seldom find it to write about. But just to prove that it can happen, prepare yourself for something 100% brand new.

A Porsche! Have I got your attention yet? Well, those of you who follow full-scale aviation have no doubt already heard that another German company, the one that makes Porsche modeler cars, has designed and is flying a light plane engine. I believe it's a six-cylinder opposed, currently undergoing flight testing in a Cessna of some type.

What's even newer news, and far more exciting to us, is that a Porsche engine for model airplanes is also undergoing flight tests. The picture included will not be the best one you'll ever see—quite frankly, it's a photo from a magazine page. But on

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FOUR-CYCLE

(Continued from page 88)

the original, one can plainly see the Porsche emblem, and the text describes the engine as being of 40cc (2.4 cubic inch) displacement, and capable of producing 2.7 horsepower at 7,000 rpm. It's being flown in a model with a 2.5-meter (8.2-foot) wingspan, which is all I can tell you at the moment.

The engine shown is a prototype, and to the best of my knowledge, none are available for sale, whether they'll ever be produced and available, your guess is as good as mine. But rest assured that I'll share whatever information that comes my way on this interesting development. And don't forget that you first read about it in "Four-Cycle Forum"!

The Cipolla* 120 4T T.S.V. might be another engine that you're not too familiar with, but this one's available! It's made by Motori Cipolla in—you guessed it—Italy. The enclosed photos will tell you some of the basics of the engine—4T indicates "4 times," and the T.S.V. means "Twin-Shaft Valves." In the latter respect, it's similar to the H.P. and Webra engines which also use the head-mounted rotary valve system. The rotary valves are driven by a rear-mounted external-toothed belt. The forward-mounted carburetor feeds directly into the intake valve and faces straight into the slipstream. This is a real disadvantage during long ground operations on dusty fields, in which case I'd recommend a filter of some sort.

Spec-wise, the Cipolla 120 has a displacement of 19.99cc (1.20 cubic inches), with a bore of 31.90 mm (1.256 inches), and a stroke of 25.00 mm (.984 inch). Its weight is 820 grams—28.92 ounces. The power of the engine is claimed as 2.1 horsepower at 9,600 rpm, with a speed range of 2,000 to 10,000 rpm. As far as I know, the Cipolla 120 is not currently available here in the United States, but is priced in Italy at 235 lira. Again, check with your bank for the current exchange rate. The address given at the end of the article can be used for further information.

Last but certainly not least are the photos of the OPS-20 4OHC four-stroker, which allows you to see some of the internal workings of this rather unusual engine. Unusual because so far it's the first production engine to use a single overhead camshaft to operate rocker arms and, in turn, the valves. The OHC stands for Overhead Cam Shaft. More details about this valve-drive system can be found in Peter Chinn's excellent book, *Model Four Stroke Engines* (available from *M.A.N.* for $13.95 plus $1.50 postage and handling; see the *M.A.N.* book ad in this issue for further ordering information).

The OPS-20 further gets its name from the 19.75cc displacement; being 1.20 cubic inches. It has a bore of 32 mm (1.26 inches) and stroke of 24.50 mm (.96 inch). Its weight is 1,090 grams (38.44 ounces), and it's rated at 2.10 horsepower to 11,500 rpm. The OPS-20 4OHC, like all other OPS engines, is imported by Shamrock Competition Imports*.

These aren't all of the interesting things that I ran into in Deutschland, but it's all the space I'm allowed. Do tune in again.

Eloy Marez, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the manufacturers mentioned in this article:*

Wolfgang Seidel, Scheffelstr 20, D-7505 Ettlingen, West Germany.

Motori Cipolla, Via Gobetti Nr 2, 1-20090 Trezano sul Naviglio, Milano, Italy.

Shamrock Competition Imports, P.O. Box 26247, New Orleans, LA 70186. ■

GOLDEN AGE

(Continued from page 79)

1960. In the same period the first commercial proportional systems were also introduced. These became the ultimate doom of the reed systems, but that's not to say that you couldn't fly with reeds today if you were so inclined.

The superheterodyne reed system was compact since it used transistors and circuits. This allowed the receiver size also to be made more compact and eliminated the labyrinth of wires which were once so common.

Min-X also manufactured a version of this system known as the "brick" concept. This ten-channel reed package reduced installation needs considerably. The four Bonner Transmite servos were mounted in an aluminum frame along with necessary plugs and switches. It also used one of the first Ni-Cd batteries.

In this "brick" the lower two servos operated the engine and rudder controls. The upper left servo was for elevator. The upper right servo output arm was connected to some Rube Goldberg-style levers. The final lever, which actually operated the elevator, swiveled on the elevator servo output arm. This ingenious mechanism allowed the elevator pushrod length to be altered (elevator trim) throughout the elevator servo's output

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GOLDEN AGE

(Continued from page 91)

range. It required two servos to have elevator and trim!

Actuators and/or servos were not normally included with early R/C systems, you had to buy them separately. Looking back, the probable reason for this was because the companies which were producing radios were small and were swamped just trying to keep up with the advancements in technology. It was helpful to have independent actuator manufacturers such as dmeco, Cobb, and Bonner.

Howard Bonner's escapement equipment firmly established him in the R/C industry. This base allowed him to progress easily into servos when the reed systems became popular. His initial servo was rather large and cumbersome. Then, along with the dmeco Multi-Servo, his Duromite reed servo dominated the R/C market. As with his compound escapement, the Duromite was a unique design aimed at simplifying production. In contrast to the others, the Duromite fulfilled the desire to have all the components enclosed in a case. This was accomplished with extensive tooling, and produced cases which also served as the gear train and switch carriage, and motor mount. Gear shaft bearings, etc., were precisely punched and formed into the very thin aluminum cases. As a result, many a curious modeler was dumbfounded upon removing a Duromite cover and finding a mess of loose parts. Assembling a Bonner servo could be an arduous endeavor to the uninitiated! Otherwise, it can be said that the Duromite operation was excellent and the concept provided both light weight and low cost.

With the advent of receivers without relays and the need for amplification to the servo, Bonner managed to find room in the same case for the necessary electronics. The only difference in outer appearance of a Bonner Transmite servo was the name labeled on it. The Bonner Transmite dominated the final reed system market. Bonner Specialties was a prominent force in the R/C industry and eventually led into proportional as we shall see.

Hal "Pappy" deBolt, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in this article:*

Midwest Products Co., 400 S. Indiana St., Hobart, IN 46342.

Frank Zaic, Box 135, Northridge, CA 91328. ■

PATTERN

(Continued from page 82)

Airtronics Inc., 11 Autry St., Irvine, CA 92718.

GM Precision Products Inc., 510 E. Arrow Hwy., San Dimas, CA 91773.

Sig Mfg. Co., Montezuma, IA 50171.

Craft-Air, 6860 Canby Ave., No. 120, Reseda, CA 91355.

Balsa USA, P.O. Box 164A, Marinette, WI 54143.

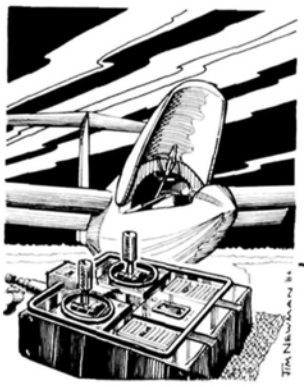
Bridi Aircraft Designs, 23625 Pineforest La., Harbor City, CA 90710. ■

COCKPIT

(Continued from page 68)

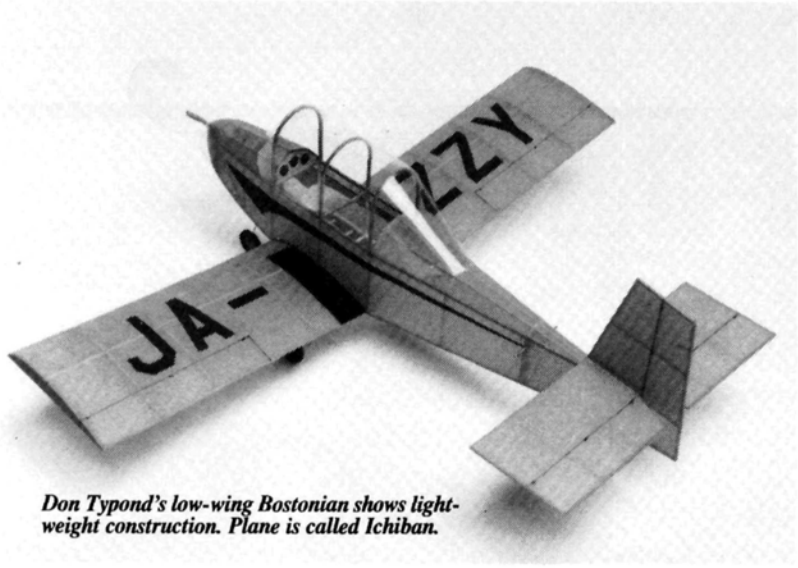
bombs on the racks. They can also carry 24,500 pounds of weapons, the equivalent of hanging a normally loaded B-25 bomber on the shackles. To handle all of the weight, over 60% of the airframe has been redesigned and its life expectancy stretched out to 16,000 flight hours. Considering that it's difficult for a squa-

(Continued on page 96)



Soaring News

by JIM GRAY



Don Typond's low-wing Bostonian shows lightweight construction. Plane is called Ichiban.

CHUCK ANDERSON* has a computer program for the Commodore C-64 and the IBM PC and Macintosh which will plot airfoils for you to any desired size compatible with R/C sailplanes. Here are some of the features of Chuck's program: it will print up to nine copies of any foil. The printer selection from menu plots NACA 4-digit, NACA 5-digit, and Quabeck airfoils without the need for entering coordinate data. It can plot additional airfoils without re-running program from scratch, max chord 25 inches. The C-64 data entry program allows resaving the data file without changing the name. The C-64 and MS-DOS programs have a utility program that converts coordinates to a standard form—it also combines the upper surface of one foil with lower surface of another; owners of earlier programs can upgrade to the new version by returning original disc with $5. Write for the original program (about $25).

The data files include 84 free-flight airfoils and 50 sailplane airfoils. Among the R/C foils are NACA, Eppler, Wortmann, Selig, Ritz, RAF, Clark YH and Gottingen. The free-flight foils add Benedek, Davis, Goldberg, Rhodes St. Geneve, Hatschek, Isaacson, Lippisch, Miser, Neelmeyer and many others.

Glide Design Program

Eddie Dumas has written a good sailplane performance prediction program for the C-64 and C-128 computers, based on the work of Martin Simons (author of *Model Airplane Aerodynamics*). The program is very easy and is highly recommended. The cost is $20.

Contest Soaring Program

Chuck Anderson also offers some contest scoring programs that will calculate, print and store the data. Those who might want a copy can send $10 to the address at the end of this article.

Japanese R/C Glider Association*

This national organization has a magnificent newsletter with many drawings, photos, three-views, hints and tips, and cartoons. Yes, it's printed with ideographs, but you needn't let that bother you. All of the serious info can be understood easily with reference to the drawings. One specially good feature is the monthly presentation of full-size airfoil plots with chords ranging from 140 mm to 270 mm (5.6 inches to 10.8 inches).

If you're like me, you'll be interested in any kind of new and different sailplane, so cast an eye on the photos included with this column and enjoy the unique offerings of James Stevens*. He calls his sailplanes T'tse, Moose, Mini-Moose, Maxi-Moose and Manta Door. Why? I haven't the foggiest idea. All I know is that the Manta Door is some kind of special. It looks like nothing I've ever seen and it flies very well, according to Jim. The Moose designs use elliptical wing planforms that give them an air of old-timers. The T'tse's are sleek, T-tailed designs which also come in various sizes (I, II, III) with polyhedral wings shaped much like the Aquila-Sagitta planforms.

The Manta Door flying wing sailplane. See text.

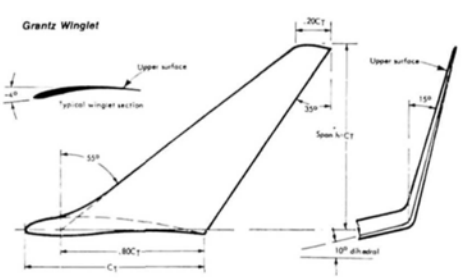
Old Timers Arise!

Back in the late '30s and early '40s I built a lot of rubber-powered scale models and a few HLGs—plus a thermal glider or two, including the famous Zaic-designed Thermic 72. However, I never built some of the more interesting sailplanes (gliders) produced in Canada*. These include the free-flight Muskoka, Soarer, Super Soarer, Gremlin, and C.A.F. Trainer no. 1. These are rather small machines but could be used with some of the latest Micro-miniature R/C gear.

The whole point of this is to acquaint you with a great source of rubber-powered scale models of the stick-and-tissue variety, plus a few of the vintage glider models as mentioned. You just might want to write them and ask for the illustrated catalog covering these models. Prices are reasonable, and the quality is claimed to be excellent.

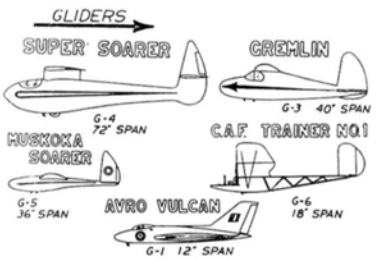
News Abounds

Every once in a while I receive interesting tips and hints to improve my modeling skills, and I'm glad to pass them on. For example, I receive an excellent monthly newsletter of the Dayton Area Thermal Soarers* called "Glide Lines." In the issue that covered their December '86 meeting, Tom Botkin presented an article that really stuck home—a real "How To" entitled, "MonoKoting Made Easy." It's far too long to present here, but I think if you wrote Ken Allen, the editor of "Glide Lines," he might send you a copy of that article or issue. It's well worth it! Please send him a self-addressed, stamped envelope with your request.



Beautiful, Interesting, Different

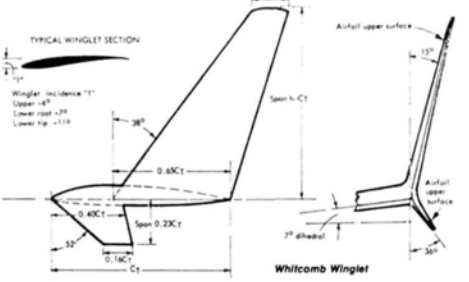
I'll give you a couple of ideas about what's covered. There's cleaning covered surfaces with lighter fluid; removing all Teflon coating from the iron; blotting MonoKote with a sticky pad of wide masking tape to remove dings; using break-away blades; trimming and cutting using a buffer of tissue between iron and covering when recovering an old surface; how to use flat safety glass for cutting the MonoKote on a smooth surface; how to cover complex surfaces; how to do a "show" class covering, and much much more. Get a copy!

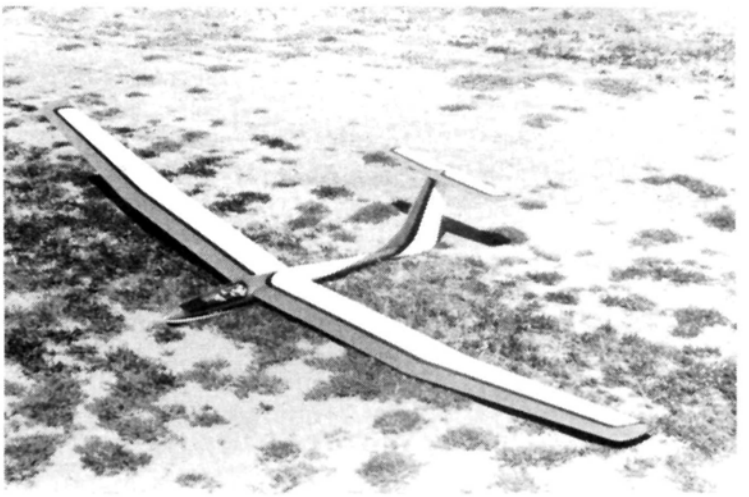


A visual altimeter idea—really great and simple to do. This idea appeared in *Radio Control Models and Electronics**, a British publication. The basic idea is to place stripes on the bottom of your wing in contrasting color and varying widths. As the flight altitude increases, the eye can only pick out stripes of increasing width. The width of the stripes is based on the resolution of the human eye, and from this you can calculate how high your model may be. The wing should be covered with transparent tissue or mylar film in white or yellow. Dark strips are painted or ironed onto the wing, running from leading to trailing edges, i.e., across the wing parallel with the chord. The height can be calculated according to the number of strips visible as follows: six stripes—below 200 feet; five stripes—200 to 400 feet; four stripes—400 to 800 feet; three stripes—800 to 1,200 feet; two stripes—1,200 to 1,700 feet; one stripe—1,700 to 2,500 feet; out-of-sight—over 3,000 feet.

I'm sure that a similar table can be worked out based on the span of the

(Continued on page 116)





T'TSE III, a modern sailplane by Jim Stevens. The sleek T-tail design has polyhedral wings much like Aquila-Sagitta planforms.

COCKPIT

(Continued from page 93)

dron pilot to actually log much more than 150 to 200 hours of F-15 time a year, that's a long, long time.

The F-15E also has one of Martin Marietta's Low Altitude Navigation and Targeting InfaRed for Night ("LANTIRN," don't you just love the military's need for acronyms?). This little gizmo does some fantastic stuff. For instance, when flying at night it looks ahead and its infrared creates a daylight quality video picture on the cockpit display. The targeting side of LANTIRN lets the crew pick out and designate targets from ten miles away in all sorts of weather and at night. This system creates the airplane's own daylight.

As if creating daylight wasn't enough, the LANTIRN system can also be tied into the F-15E's digital flight control system so that the airplane can automatically follow the terrain at altitudes as low as 200 feet!

Incidentally, from a modeling viewpoint, it's important to know the rear seat is set up with four cathode ray tubes (the front has three) that are controlled with two computer joy sticks. These display information from the radar, electronic warfare, or infrared sensors, monitor aircraft or weapon status and possible threats, select targets and use an electronic "moving map" to navigate. All of this is menu driven and represents the latest in onboard computerized weapons systems. The same system *cannot* be reprogrammed to balance the pilot's checkbook.

Although there are over a thousand F-15s out there boring holes in the stratosphere, the "E" models won't be truly operational until January of 1988. In the meantime, those other models, the ones with fuzzy-cheeked 23-year-olds on board, are making sure we can always look up and see the friendly skies. ■

PEASHOOTER

(Continued from page 23)

servos and these were mounted in the Futaba servo tray after cutting off the side mounting flanges. A ⅜-inch-square spruce crossmember is installed in the two notches in the top of the fuselage doubler and the servo tray is mounted on these from the bottom. Mount servos as shown in the bottom view on the plans. Connect the servos to the rudder and elevator with Ny-rods or make solid pushrods if you prefer. If using Ny-rods, make sure you make a guide for them at F3 and F4. After installing the servos and making the connection to the control surfaces, the rear of the fuselage can be finished. The top is planked with ⅛x¼-inch strips of balsa and the bottom is sheeted with the grain of the balsa running crossways to the fuselage. The top planking starts at F2 and goes to the extreme rear of the fuselage.

Bolt the engine mount to the firewall and set up the fuel tank in the tank compartment. Make the fuel tank compartment hatch top of a 1-inch-block or laminate two sheets of ½-inch balsa. Make sure you fuel-proof the tank compartment and also the forward face of the firewall. This should pretty well finish the fuselage and it can now be sanded to final shape.

The wing is very easy to build and will go together very quickly. Start by making the leading and trailing edge sheeting and spar assemblies. Cut two lengths of 1/16x2-inch sheets of balsa to a length of 26½ inches. Cut two lengths of ¼-inch-square balsa to 26½ inches. Use a sheet of wax paper or plastic film under your work and lay a sheet of the 1/16x2-inch balsa on your work area. Lay a length of the ¼-inch-square flush with one edge of the sheet and glue with cyanoacrylate. Repeat this with the other two pieces. These are the leading edge sheeting and spar assemblies.

Cut two lengths of the 1/16x1-inch balsa 27 inches long. Cut two pieces of ¼x⅜-inch balsa to a length of 27 inches. Lay a sheet of the 1/16x1-inch on your work area. Butt a length of ¼x⅜-inch against one edge of this sheet with the ¼-inch side

against your work area and glue together with cyanoacrylate. Make a second such assembly. These assemblies are the trailing edge sheeting and trailing edge assemblies.

Lay a leading edge assembly over your plan and a trailing edge assembly also. Connect these with an A rib at the tip and an A rib at the innermost A-rib location. Glue these in position, making sure that they're properly seated with the rear sheeting tight against the cutout in the bottom of the rib. Glue the front of the rib only to the spar. Don't glue to the sheeting. Install the remaining A ribs in the same manner, making sure they're each seated correctly.

Glue the rear part of the B ribs in place. The innermost B rib should be glued at a slight angle to allow for the dihedral of the wing. Glue the top ¼-inch-square in the notches in the tops of the ribs. Install the ½-inch-square leading edge in the notches in the front of each rib. Fit the front part of the B ribs in place with the innermost one at the angle of the rear of this rib previously installed.

Build the opposite wing panel identically. Add the 2x1/16-inch sheeting to the tops of the panels and the 1x1/16-inch

(Continued on page 102)

Giant Steps

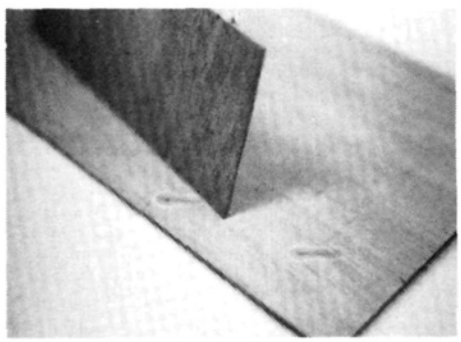
by DICK PHILLIPS

BUILDING from plans has several advantages. For one, there are many plans for large models, about two hundred of them according to my records. In addition, the cost of building from plans is usually significantly less than building a similar model from a kit.

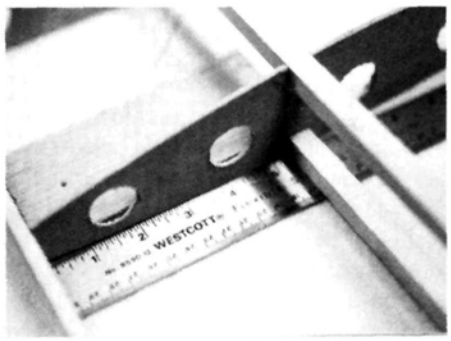
The lower cost in dollars is paid for in labor spent in making up patterns and the parts required to build the model. There is still no free lunch, after all.

Another savings can be realized by using materials other than the conventional (and often expensive) ones we've used for building in the past. Balsa formers and wing ribs can be replaced by mahogany door skin material or by foam core parts. For the sake of clarity, door skins are mahogany plywood of either 3/32-inch or 2-mm thickness. (They are close to the same size, whichever measure is used.) Foam core is a material formed from a styrofoam core covered with either artists card stock or kraft paper.

Another material which can be inexpensive is poplar plywood. We know it as Lite-ply and it may often be obtained from the local lumber yard, either as an "in-stock" item or on special order. Lite-ply is a familiar material, so I won't spend much time on it here. Be aware that you can often obtain it through your local builders supply, if you're willing to take a 4x8-foot sheet.



1. Thin mahogany plywood door skins make a good substitute for more conventional materials.



2. Holes cut in mahogany plywood reduce weight slightly, however material is not excessively heavy.

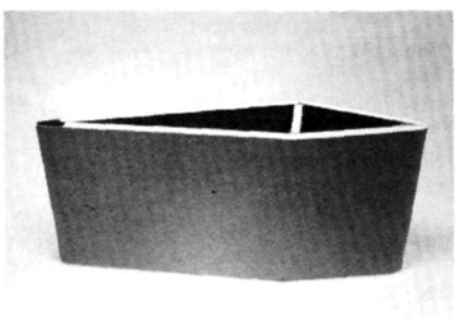
Door skin material is a bit thinner than what we're used to in the size mentioned. If used for larger parts, it's often a good idea to stiffen it with stick stock so it lays flat and stays that way.

While a little harder than poplar plywood, door skins are easily worked with the usual hobby knives and tools. It works particularly well as wing ribs, as they are usually mounted to several spars which hold them straight and true.

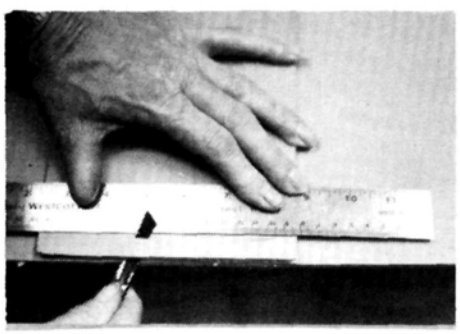
The weight of door skin material is slightly more than that of balsa, and about the same as poplar plywood. This is not usually a problem in the larger model. Due to its strength, lightening holes may be cut in the material without compromising its ability to bear loads.

Door skins are wood, so all the glues we use are compatible with it. I use Satellite City's* Hot Stuff almost exclusively and have had no problem with glue joints. As it is slightly more porous than other woods we use, the thicker variety of the cyanoacrylate glues is recommended.

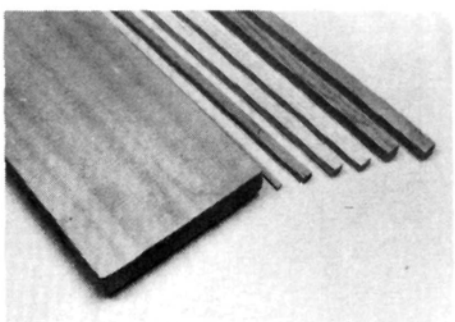
Foam core doesn't have the strength of mahogany plywood, but it may readily be used in some areas. Where parts do not bear any significant load and are used mainly to provide shape, foam core works well. Wing ribs are a good example. The ribs don't carry any significant load, they simply provide the shape necessary for flight. Some ribs should not be made of foam core, of course. Those which support landing gears, wing struts, or have other structural functions should be made up from wood; often from aircraft-grade plywood or as specified in the plans.



6. Diamond-shaped wing made from foam core. Spar is made from same material.

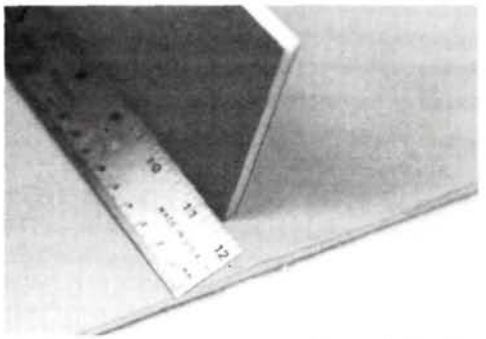


7. Trailing edge for one-piece wing is trimmed at an angle to provide thin trailing edge.

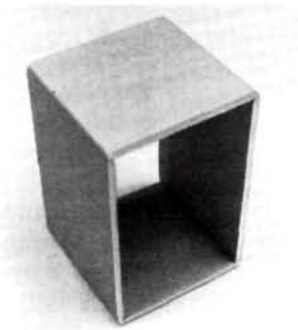


8. Sitka spruce is readily available from home-built airplane supply houses.

Cut building costs without sacrificing structural integrity.



3. Styrofoam center between card-stock facings is light, strong, and inexpensive.



4. Foam core can be made into simple structures that are strong and light.

5. Almost any shape can be built from foam core using wood strips.

Foam core is easily worked, and can be cut readily with the common hobby knives. The surface of the material, whether artists board or kraft paper, does not sand at all well, even on the edges, so sanding should be kept to a minimum.

I've heard (and read) that the foam core materials react badly to the cyanoacrylate glues. This has not been my experience. I've found that cyanoacrylates work well with the foam core I use and have had no problems with the material delaminating or melting. Keep in mind that there may be different chemical compositions of foam core on the market and some of these *might* react badly. I just haven't had that experience.

There have been model builders who have used foam core almost exclusively in the construction of a model. I know of a Fokker D-VII built almost entirely from foam core and the model was flown extensively without any harm coming to it.

Such construction works best with assemblies which are flat and have no compound curves. While I haven't tried this specific construction method myself, careful planning and layout would permit the construction of a type of monocoque fuselage with only minimal internal structure. You score the material on the side which will be inside the structure and fold it along the score lines. As you can imagine, this would require some careful planning and accurate layout work to arrive at the desired shape.

In another instance, I know of a wing which was made up from a sheet of foam core. The resulting shape was an elongated diamond and was symmetrical in form. Despite its odd shape, it flew well. The ease of construction and the minimal construction time required provided a significant advantage.

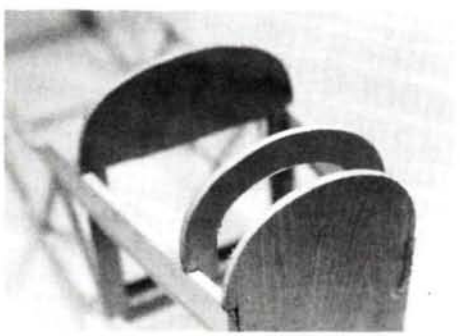
While constant-chord wing planforms would be easiest to make up with this method, there is no reason other shapes could not be constructed with proper planning. For a "quick and dirty" wing, the method has a lot to recommend it.

Artists card stock can be used as a covering material which duplicates sheeted areas in the original airplane. Using card stock is a little different than sheeting with balsa. For one thing, no sanding is possible after the card stock is installed; it just won't stand it. There are a variety of such materials available and it's a matter of finding out what is available in your area and then choosing the one which suits you best. As with any new method, it's best to do some experimenting before trying it on your latest creation.

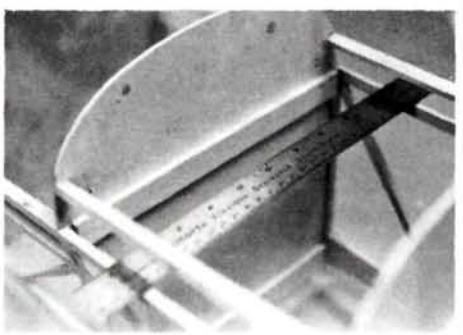
Basic construction can also benefit from substitute materials. If you have a radial arm, table, or band saw, you can make the most of your stick stock. The basic material can be any straight-grained softwood that's readily available.

Many modelers refer to any wood which is harder than balsa as "hardwood." This is not accurate. Hardwoods

(Continued on page 117)



9. Kitchen cabinet plywood made into inexpensive formers for scratch-built construction.



10. Sitka spruce stiffener applied to lite ply former to eliminate curling.

Product News

TOP FLITE'S HOT SOCK

The Top Flite Hot Sock Iron Cover is a soft, super-smooth cloth bootie that fits right over your iron shoe. Your iron works just like normal, with the heat transferring directly through the cloth, but the surface that touches your covering film is as smooth as the proverbial baby's bottom. Surface scratches are virtually eliminated. The Hot Sock is especially designed for Top Flite's MS-2 iron, but should work equally well on most other makes. It's available now at your local hobby retailer. For more information on Hot Sock contact Top Flite Models, Inc. (2635 South Wabash Ave., Chicago, IL 60616).

GIANT SCALE P-47

Roy Vaillancourt (18 Oakdale Ave., Farmingdale, NY 11738) introduces a giant-scale semi-kit of the P-47 Thunderbolt. The model is scaled at 2.3 inches to the foot. This results in a wingspan of 92 inches and an overall length of 78 inches. The ship is intended to weigh 26 to 32 pounds with a recommended engine size of 2.4 to 3.7 cubic inches. The semi-kit includes a fiberglass fuselage, fiberglass cowl, clear plastic canopy, and plans. The plans consist of seven sheets showing all ribs and formers plus wing, stab elevator and fin rudder structures drawn full size. Full-size patterns are also shown for the installation of three of the currently popular brands of retracts. The cowl and/or canopy are also available separately. Contact R.V. for more info.

SUPER LASER

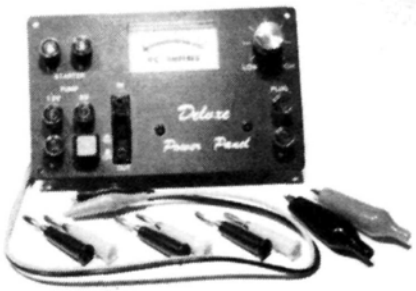
Super Laser is Hobby Lobby's design for the highly experienced R/C flier who wants the ultimate in aerobatic performance. The airplane is mainly pre-built so that your building time will be spent mostly on radio installation and finishing. Super Laser has a 67-inch span wing of wide chord, wing area of 743 square inches, fuselage length of 54 inches and an approximate 8¼-pound flying weight. The wing profile is 12% symmetrical. The fuselage comes in a hand-assembled light-ply-and-balsa configuration. The wing is foam, sheeted with balsa.

QUIETEST MUFFLER

The quietest muffler in the world makes a glow engine sound like an electric, and it actually increases power and regulates tank pressure. A running glow engine causes noise from several sources: there's no prop noise, induction noise, mechanical (gear and metal) noise and exhaust noise. The PST-PC Muffler elminates the exhaust noise. Initially we offer only a single muffler size. It's correct for all .45 to .90 two-stroke engines and .60 to 1.30 four-strokes. The muffler is covered by a German patent. From Hobby Lobby (5614 Franklin Pike Circle, Brentwood, TN 37027).

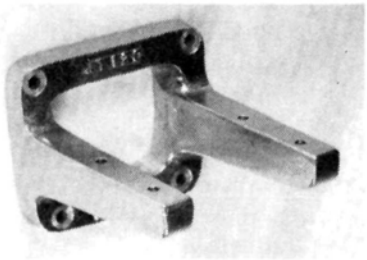
NYLON TUBING

Off the Ground Models, Inc. (606C W. Anthony Dr., Urbana, IL 61801) Nylon Tubing is a very versatile ⅛-inch diameter, flexible nylon tube that can be used in a variety of applications. It can be used for spoiler tubing in sailplanes, to route the receiver antenna through or along the inside of airplane fuselages, to route cooling water in marine applications, on pressure systems and even in most places that you might normally use brass tubing. Each package contains one piece eight feet long.



DELUXE POWER PANEL

This new Deluxe Power Panel from Circus Hobbies (3132 S. Highland Dr., Las Vegas, NV 89109) offers the hobbyist the ease and convenience of a solid-state IC design that can be used with any type of sealed or wet 12-volt battery. Unlike other models, this power panel can remain hooked up to the battery supply because there's no current drain when the panel is not in use. The Deluxe Power Panel supplies direct power for a 12-volt engine starter, 12-volt fuel pump, and 1.5-volt glow plug.



2-CYCLE MOUNTS

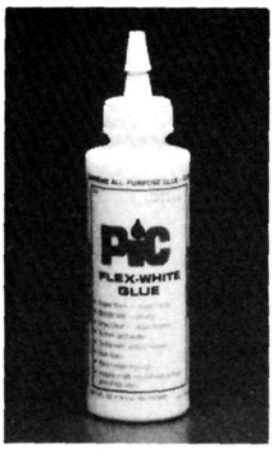
Two-cycle engine mounts for the K&B 20-45 Sporster, Max 40 FSR, Max 61FSR, 61RF, 61SF, and Max 120S engines. The mounts are drilled and tapped for these engines; just bolt them on. They're cast aluminum, machined and bright polished with engine mounting screws included. Also new from J'Tec is a heavy-duty, formed aluminum engine mount to fit the Quadra 35-50, Zenoah G-38 and Zenoah G-62 engines. This mount is easy to install and provides clearance for the J'Tec and similar mufflers. Rear of the mount will accommodate all spring starters. These new items are available at most hobby shops or can be ordered directly from J'Tec (164 School St., Daly City, CA).

LOCTITE E-POX-E

Not just another epoxy, Loctite's new E-POX-E systems have been formulated for the hobby and craft market. They're not just another hardware-store epoxy repackaged for modeler use. This epoxy will give you a working time for approximately 5 minutes and will cure crystal clear. The dried product is non-brittle. It has proven to be very strong, flexible and sandable.

PLASTIC SPREADERS

Loctite Plastic Spreaders have been used for years by expert body-and-fender men in the automotive industry as a tool for spreading various glazing compounds and putties to a feather edge. These spreaders are offered in four sizes; three feature smooth edges and one 5-inch spreader has a serrated edge. Loctite Corp. has developed a Hobby and Craft Program specially designed with the modeler in mind. These products have been approved for modelers' use by modelers and are available through the Sticky Group International at your local hobby dealer or through one of the following: Frank Tiano Enterprises, 2460 S.W. 85th Terrace, Davie, FL 33328; Robart, 310 No. 5th St., St. Charles, IL 60174; House of Balsa, 20130 State St., Cerritos, CA 90701.



ALIPHATIC GLUE

The "Flex-White" from Penn International (943 Stierlin Rd., Mount View, CA 94043) dries clear but remains flexible and is well-suited to bonding porous and non-porous materials. The adhesive has a very high solids content and as such is tacky and rapid curing. The high solids content makes the product superior when bonding porous materials because the glue won't soak through and blemish these materials. Particular mention is given for the use of the product to bond all clear plastics: plastic model kit canopies, R/C kit plastic windshields, clear plastic windows for miniature doll houses, etc.

FLYBABY COMBO

Aerodrome Models, Ltd. (2623 S. Miller Rd., Saginaw, MI 48603) announces the best of both worlds. Imagine going to the field and flying a classic low-wing Flybaby and then after a short field conversion taking to the air in a super sporty Flybaby Bipe! Both versions are extremely aerobatic yet gentle and very forgiving. The Flybaby features a 56-inch wingspan with a wing loading at 5 pounds, 22 ounces. Uses an engine from .30 to .45, four-stroke. The Flybaby is converted to the Bipe in under 10 minutes and features plug-in cabanes. The Flybaby Bipe wingspan is 44 inches; wing loading at 5½ pounds is 16 ounces! No modification in the fuselage or balance is required. Aerodrome kits are precision hand-cut from hand-selected balsa and plywood. They include ABS pre-cut cowl and windshield, pre-formed landing gear, hardware, and complete plans and instructions plus decals by Major Decals. (An electric version of the Flybaby is in the wings, as is a Hawker Hurricane for .60 to .90 four-strokes.)

PEASHOOTER

(Continued from page 97)

sheeting at the trailing edge. Slide the dihedral brace into the slot formed between the fronts and backs of the B ribs on one panel and slide the second panel on the other end of the brace. Trim the center of the panels for a good tight fit together and then join the panels, making sure the two panels are lined up properly. Block the tips with equal size blocks to assure alignment while the glue dries. Install the landing gear mount blocks in the bottom of the wing. The rear block fits into the wing leading edge. A section of the bottom rear edge must be cut away for the installation of this block. When the proper fit has been achieved, epoxy the blocks in place.

Install the ¼-inch dowel in the leading edge at this time. Drill a ¼-inch hole through the leading edge and the two center ribs as deep as the dihedral brace. *Do not* drill into the dihedral brace. Epoxy the dowel in place. Add the center section sheeting on the top and bottom of the wing and add the tips to complete the wing structure. The wing can now be sanded to final shape. Round the front of the leading edge to a blunt radius for a docile flying model. A sharper radius will result in a quicker-reacting model that should only be flown by an experienced pilot. Install the wing mount blocks in the fuselage against the fuselage doublers and F-3. Fit the wing dowel to F2.

Fit the wing to the saddle and sand where necessary for a good fit. Line the wing up by measuring from each wing tip to the tail post, making sure the measurement is the same on both sides. When proper alignment has been achieved, drill through the wing trailing edge and wing mount blocks on both sides with a #25 bit. Enlarge holes through wing after installing a ½x4-inch strip of 1/16-inch ply centered over the holes. Use a #7 bit to enlarge the holes. Tap wing mount blocks for a 10-20 bolt and secure wing with 1-inch nylon bolts.

Install the ½-inch filler block between the wing trailing edge and F-3. Make up the ailerons and hinge to the trailing edge. Cut out the hole in the top sheeting for the servo and build up the servo mount in the wing center section. Mount the servo and make linkage connections to the ailerons. *Make sure you relieve the block behind the wing* so that the aileron cranks can have full rearward movement when the wing is installed.

Bend the landing gear legs as shown in the plan patterns. Install the legs in the wing landing gear blocks with gear straps and screws. Bind the two legs together and solder as shown. Leg fairings are formed by cutting a ⅛-inch ply core between the legs and sandwiching the core between two 3/32-inch balsa parts. Carve and sand the fairings to a streamline shape. Wheel fairings are built-up from parts cut. Front view shows laminating of various parts to build-up fairing blank. Carve and sand to streamline shapes.

Drill axle hole through fairing sides in proper location. Cut two pieces of ⅛-inch ply ½x2-inch and imbed these in the inside of each fairing with the piece extending back from the axle hole. Piece should be over axle hole at the front end so that the axle goes through the ply piece. Assemble fairing to axle with wheel using a wheel collar on the outer end of the axle and a nylon steering arm on the inner side of the wheel. A small screw through the ply plate and into the steering arm will keep the fairing in place. Alignment of the steering arm on the axle with its locking screw will hold fairing in correct position.

Cowl is formed by gluing together the various cowl blocks that have been cut from ½-inch balsa. Install the engine and fit cowl over it by cutting away inside of cowl where necessary to clear engine parts. With cowl fit over engine, install the spinner and carve cowl to shape, being careful to make a neat fairing into spinner. Make sure the throttle lever has room for full movement and cutout area for muffler installation to engine.

Make headrest by gluing two ½-inch headrest parts cut from pattern plan,

together. Carve and sand to streamline shape and fit to top of fuselage decking behind cockpit location. Mark cockpit opening and carefully cut through top decking to form cockpit.

Prepare model for covering by removing all removable parts. Remove engine, radio gear, and control surfaces. Give all parts a final sanding with fine sandpaper to prepare for covering. The smoother the structure, the smoother the covering will go on. Flaws in the structure will show through the covering.

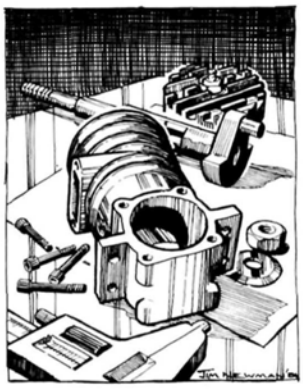
My prototype model was covered with Coverite's* new Black Baron film. This new film will give the model a beautiful finish and is easier to use than other films I have used in the past. It irons on at a lower temperature than other films and is easier to form around compound curves. The fuselage was covered with Flag Blue, the wing with Cub Yellow, and the tail surfaces with White. All trim on the model was done with Coverite's Graphics Trimsheets, which are blank sheets of a cast vinyl material with a pressure-sensitive adhesive that adheres better than anything I've ever seen. I've used this material for trim on all of my scale models for many years. The fuselage stripes were done in two sections. A paper pattern was made and the shape cut from the blank trimsheet with a sharp X-Acto blade. A paper pattern assures identical shapes on both sides of the model. The trimsheet material easily conforms to curves and compound surfaces.

The cowl and wheel fairings were painted with Coverite's Black Baron spray epoxy. The Flag Blue matches the film color perfectly. The trimsheet trim formed over the curves of the cowl and fairings and looks like it was painted on. The stripes on the rudder were also cut from the trimsheet material as was the leading edge trim and headrest trim.

The star insignia on the wings are also cut from the trimsheet material. First, a blue circle was cut out and put in place on the wing. Then the white star was applied over the circle and finally the red center circle was added. The Thunderbird squadron insignia was done the same way. A paper pattern was made for each of the three layers and the parts die-cut and installed in place, one over the other. The numbers on the fin and fuselage top were also cut from the trimsheet material.

Cut the windshield from clear plastic and install. If you want to add a gun sight, as I did, this is made of a length of dowel

(Continued on page 106)



About Those Engi

by JOE WAGNER

IN MY previous column I talked a bit about engine corrosion problems. I limited that discussion to internal corrosion; ball bearing rust in particular. In this installment I'm going to talk about a more common sort of engine "corrosion": external grime and baked-on carbon deposits.

All of us who fly our model engines suffer from this. And one main reason for today's use of synthetic lubricants in glow fuel is to reduce the dirty-looking accumulations of crud that spoil the looks of the outsides of our motors, and clog up their insides as well.

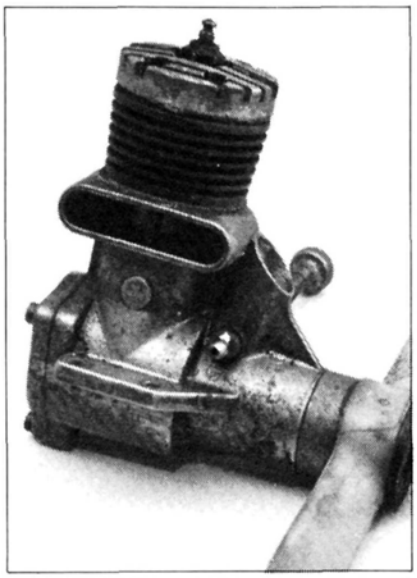
The modern synthetic-oil fuels do a good job of eliminating deposits, all right. Unfortunately, they don't do so good of a job in protecting ball bearings from rust, or cylinders from excessive wear when a hot, lean run occurs.

Thus, many of us model airplane fliers still use castor oil in our glow fuels. And we continue to suffer from the horrid dark-brown coatings on our engines that castor oil produces.

Inside the engine this is customarily referred to as "varnish." It makes pistons and cylinders stick together. Removing it isn't usually a difficult job, though. Take the engine apart and scour away the varnish with steel wool, hot water, and a detergent such as Tide.

The outside of the motor is tougher to clean, as we all know so well. There are too many crevices and hollows and projections, all of which collect gunky deposits very quickly indeed if we neglect cleaning our motors after every flying session. Engine heads and the spaces between cylinder fins seem especially prone to acquiring baked-on brown coatings.

If you get to work fast enough on this pesky external grime, it's not really hard to remove. Much of it will rinse off with an application or two of a household liquid cleaner such as Fantastik. But if it gets a chance to oxidize well onto the surface, it often seems like it becomes a part of the metal itself.



This 1960 Johnson .35 bears twenty years of accumulated grime and baked-on exhaust.

Modelers and engine manufacturers have searched for years for a solvent that would remove the ugly brown deposits from model motors without harming the metal. So far as I know, none has yet been discovered.

Lots of solvents will take off *some* of the external crud. Methanol, acetone, mineral spirits, trichlorethylene, methyl ethyl ketone (MEK), toluene, lacquer thinner, tri-cresyl phosphate: they'll all remove oily dirt and sludge very quickly. But even a week-long soaking in any of these powerful solvents won't affect a chocolate-colored Fox head in the slightest.

Paint removers which contain lye: sodium hydroxide—may possibly attack baked-on castor oil residue. I don't know. But I do know this: lye attacks aluminum.

I've heard of a proprietary product, originally designed to remove carbonized food residues from utensils such as electric frying pans, that supposedly makes short work of model engine varnish. But I haven't been able to find any of this miraculous substance anywhere around here.

I did obtain a new product recently which is advertised as a highly potent engine-cleaning compound: Standale's K5W Engine Cleaner. It's supposed to work in an hour or so, loosening surface dirt and sludgy coatings. I tried it on some grubby old engines that I got from local modelers.

Here's what I found out. The stuff works—but not very well. On a really dirty engine, even an overnight treatment with K5W didn't remove all the gunk. True, it did cut surface sludge more quickly than a solvent such as toluene or MEK. But it wasn't any faster than a jellied methanol type of commercial paint remover I got at the local hardware store—for about one-eighth the price of the K5W. In fact, I cannot tell the two apart. They look the same, smell the same, and work the same....

So once again I've been disappointed in my search for the Miracle Model Engine Cleaning Solvent. But that has never stopped me from doing a good job of making old, filthy motors look like new again. I have cleaning methods that will remove just about every kind of surface contamination I've ever seen on a model motor—and that includes black, burnt-on castor oil twenty years old.

My methods are simple enough. But they are rather time-consuming and require lots of patient hand work.

First, I get as much stuff off the exterior of the engine as I can with a mild solvent such as kerosene. A stiff fiber brush helps dislodge dirt from crevices and hollows.

Second, I take the engine completely apart, and soak the components in butyrate dope thinner (which contains both toluene and MEK), usually for several hours or more. Then I again use a stiff fiber brush to remove adhering dirt, paint, and surface grime.

Third, to get any residue off that the solvents haven't touched, I use an old stiff toothbrush plus a kitchen cleanser such as Ajax or Comet. It takes a lot of brushing sometimes, but eventually even the stubbornest brown stain will yield.

For steel parts I often use a power wire brush: fine grade, of course. With this in

my drill press, I make short work of minor rust and baked-on varnish. But I never use a wire brush on aluminum parts. That would ruin the surface finish beyond repair.

Getting down between fins is often a problem. Brush bristles don't penetrate well between closely-spaced fins. For these I use cotton twine or string, working it like a shoeshine rag. This can be soaked in solvent, or wet with water and then dipped into dry Ajax cleanser. It needs

Safe and effective way to remove gunk is with a stiff toothbrush and a household cleanser.

frequent replacement, of course, but it's mighty inexpensive.

Straight pins do a good job of picking dirt out of screw slots and other narrow crannies. So do bamboo shish kebab skewers. Ingenuity in making use of commonly available tools and materials is always helpful!

Many times in restoring old engines to like-new condition I find screws with chewed-up screw driver slots. Often these are odd-size screws that I can't get replacements for. So I repair the heads of the original screws. That sounds as if it might be a difficult job, but it really isn't.

Most of the time no metal is actually missing from the screw slot. It's merely distorted. I therefore place the body of the screw into a clearance-sized hole drilled in a small steel block. Then with a miniature ball-peen hammer I tap the screw head back into its original shape. The screw's steel is not hard at all, and neither is the job of reshaping it.

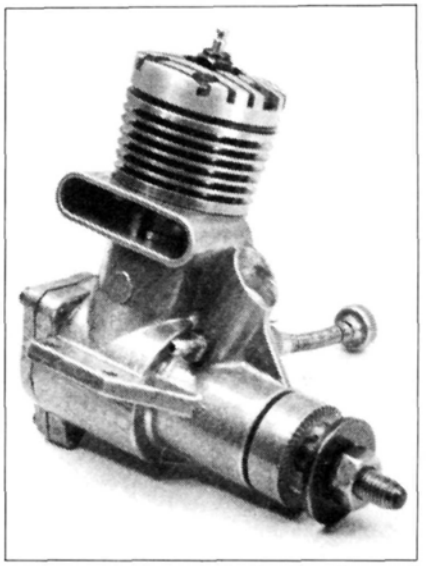
I've been describing my engine-restoring techniques in detail here because quite a few readers have written to me asking how to go about cleaning and rebuilding their older motors. (I always write a personal reply to inquiries such as this, but please include an SASE when you write to me!) Anyway, since I assume that for every reader who sends me a query, there are several others who'd like to know the same thing, this month's column has been devoted entirely to the topic of how to make a model motor look like new again.

To add a few further details and cautionary remarks:

1. When working on spark-ignition Ohlsson engines (made between 1938 and 1950), don't use any solvents other than kerosene or mineral spirits to clean the cylinder-case assembly. Between the case and cylinder there's a gasket permanently installed, which strong solvents such as acetone or dope thinner will destroy. Since Ohlsson cylinders are spot-welded to their cases, there is no way at all to replace this gasket.

2. Engines with painted parts, such as McCoy Redheads and K&B Greenhead models, can be touched up quite easily with the same kind of enamel used for painting plastic models. Clean the part thoroughly with detergent and hot water; dry it with a MonoKote heat gun; then while it's still quite warm, apply the enamel. It's sometimes necessary to do a little mixing of colors to get an exact match with the existing paint, but so many shades of plastic-model enamel are available, that's seldom a problem.

3. To preserve an engine from corrosion and dirt over a long time period, a non-oxidizing oil or grease should be liberally applied inside and out. Some modelers use products such as WD-40 or Marvel Mystery Oil for this. And they do work. But other lubricants will do as good a job or better for really long-term stor-



Like new again, the .35 after four hours of careful cleaning and polishing.

age: vaseline, automobile motor oil, or mineral oil of the type drugstores sell for laxative purposes.

4. If your motor is stiff or even frozen from lack of use and dried-up lubricant, squirt a penetrating oil such as "Liquid Wrench" into every opening. Let this soak in for an hour or so; then warm the engine with a heat gun until it's just too hot to hold comfortably. It should by then have loosened up enough for easy disassembly, followed by a thorough cleaning as described above.

In my 50 years of messing around with model engines, I've noticed again and again: clean, well-kept motors seem to run much better than dirty ones. That makes it worthwhile for me to keep my own engines from getting grimy. Maybe it will be equally helpful for you.

Joe Wagner, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

PEASHOOTER

(Continued from page 103)

and wire supports. My pilot was equipped with a white pea shooter which is simply a length of white plastic tubing. The pilot is the Black Baron, available from Coverite.

FLYING. When I got my Peashooter finished, I couldn't wait to fly it. I engaged the services of our South Jersey "Test Pilot Supreme" Sid Clements to do the initial honors. He can fly around the patch a couple of times and tell you it needs two turns of left rudder trim, or a turn of right aileron trim. This makes trimming-out a new model simple. You simply make the adjustments Sid asks for and on the next flight it does what you want it to do.

The model was fueled and the reliable K&B .40 started right up in the cold fall weather. Sid checked everything and motioned to release the craft. When I did this, it jumped into the air after a very short run. The first flight was beautiful as Sid performed most of the common maneuvers. It looked great in the air. He did some stall tests and then set-up for a landing. The landing was smooth as silk.

I flew it next. It was gentle and would do anything on command. Sid reported that everything was fine except for the wing incidence, which wasn't positive enough to fly level, hands off, at all power settings. We each flew a couple more times just for the fun of it and then I took it home and made the incidence change.

Next time out was another cold, blustery day, Sid and I alone at the field. We each flew it a few times and Sid told me it needed a little more positive incidence. I made the additional change after returning from the field.

The third time we took it to the field it was the warmest day of the season and although there was a pretty good breeze, a large portion of our club was out to fly in the pleasant temperature. Everyone crowded around as I got the beauty out of the car.

In a stiff gust, it almost stopped before it touched down.

It is a great-flying model and excellent low-wing trainer. When your model is ready to fly, be sure to check all control surface movements and it's a good idea to check them with the help of another. Many pilots have taken off for a first flight with one or more control functions working backwards.

When ready to take off, apply the power slowly. Remember, this is a tail dragger and sudden bursts of power at the beginning of a take-off run can swing the tail around. If you're flying on grass, the skid is no trouble. If you fly from a hard surface, the installation of a tail wheel in place of the skid will help. Once in the air it will do anything you want it to. Its performance depends only on the skill of the pilot. You'll be amazed at how slowly it goes when it touches down if you just keep holding it off as it gets near the ground.

If you want to fly it with a tricycle gear, you need only to reverse the landing gear leg in its mounting blocks and install a nose gear. Use an engine mount that you can mount the nose gear strut in and you can actually change the model back and forth to either tricycle or tail dragger in just a few minutes.

If you want to build this model and don't want to scratch-build, you'll be able to do so, as Coverite is working on a kit of the model which should be available shortly after you read this article. The kit that is being developed will include molded plastic parts to form the top shape of the fuselage as well as a molded cowl and wheel fairings. This will make it even easier to build for those modelers who don't like to get involved with carving

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PEASHOOTER

(Continued from page 106)

and sanding complex parts.

Whether you get a set of plans or wait for the kit, I'm sure you'll find the Peashooter one of the best-flying models you've ever taken into the air.

**The following are the addresses of the companies mentioned in this article:*

Futaba Corp. of America, 555 W. Victoria St., Compton, CA 90220.

Coverite, 420 Babylon Rd., Horsham, PA 19044. ■

4-STROKE OPER.

(Continued from page 29)

turers and engine manufacturers, of the need for co-operation in this area.

The types of four-stroke engines most commonly equipped with pinned or through-bolt prop fixtures, are the larger motors of 1.20 cu in. and upwards, but tests have indicated that these methods are not always necessary. Nor are they the only methods of preventing prop slippage if such a problem exists.

As previously mentioned, the type of engine with which prop slip is most likely to occur is a powerful single-cylinder four-stroke where torque variations through the cycle are at the highest levels. With a twin-cylinder engine of similar power output, the ratio of maximum to mean torque is much reduced (and even more so in the case of multi-cylinder engines) so the tendency for the prop to slip and suffer damage is greatly reduced.

Here it is significant that, although the O.S. company originally introduced the 1.62 cu in. Gemini-160 and 2.44 cu in. Super-Gemini twin-cylinder engines with through-bolt type prop driver assemblies, these were superseded, shortly afterwards, by a locknut type assembly in which resistance to prop slippage reverted to the traditional model aircraft engine method of depending solely on static friction between the prop driver face and the rear face of the prop boss. This works perfectly satisfactorily with these smooth-running alternate-firing twin-cylinder engines.

Torque vs. Prop Driver Diameter

If, however, resistance to slippage is to depend solely on such contact, the adjoining surfaces must not only be in firm contact, they must also be of sufficiently large diameter to deal with the torque impulses transmitted through them. In other words, *the prop driver must be of a relatively large diameter and the prop must have an equally large diameter boss.*

This is not always the case. Some four-stroke manufacturers appear to have overlooked the need to match prop driver diameters to the levels of torque that they are required to transmit. Most small and medium sized engines have prop drivers that are big enough but, in the larger engines, prop drivers are usually much smaller relative to those engines' torque levels. It is with these engines that a tendency for the prop to slip is most frequently encountered.

An examination of large and small single cylinder four-strokes illustrates this situation quite graphically. Two of the smallest four-strokes tested, the 0.21 cu in. HP VT-21 and the 0.22 cu in. O.S. FS-20, have prop driver face diameters of approximately 23 mm. These are called upon to transmit, respectively, mean torque levels of approximately 23 oz-in. and 28 oz-in. and both did so, on test, without any tendency for their props to slip.

By contrast, a powerful 1.22 cu in. engine of another make tested at the same time as the O.S. FS-20, had a 35 mm diameter prop driver that had to transmit mean torque levels in excess of 200 oz-in. with, of course, very much higher peaks occurring every 720 degrees. This, despite a heavily serrated prop driver face, it could not do without prop slippage (and consequent damage to the rear face of the prop boss) unless its optional screw-in drive pins were used and these could not be accommodated by some makes of prop having small sized bosses.

The Solution

The standard prop drive assembly of a model aircraft engine can be likened to a single dry plate disc type automobile clutch. The formula for calculating the torque that can be transmitted by such an assembly depends on four variables. These are (a) the mean radius of the disc, (b) the pressure between the contact surfaces, (c) the coefficient of friction of the contact surfaces and (d) the number of contact surfaces.

(a) The contact area of a model engine's prop driver or hub is usually in the form of a raised flat ring like the lining of an automobile clutch but having a serrated surface and, since one of the laws of mechanics is that friction is independent of the area in

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4-STROKE OPER.

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contact, it is the *mean radius* of the ring that is significant, not its area.

(b) The pressure between the contact surfaces is determined by spring pressure in a clutch and by the pressure exerted by the retaining nut in a prop drive assembly. To some extent, and especially with wood props, the pressure that can be applied is limited because this tends to crush and weaken the prop boss.

(c) The coefficient of friction or "grip" depends on the nature of the surfaces in contact. The serrated face of a prop drive hub improves grip but, if torque is sufficient to break this contact, the serrations will only serve to damage the prop.

(d) The number of contact surfaces is *two* in the case of a single dry plate automobile clutch because there are friction linings on *both* sides of the clutch plate sandwiched between the flywheel and the pressure plate. This *doubles* the torque that can be transmitted by the clutch.

This raises an interesting point so far as large single-cylinder four-strokes are concerned.

It can be shown, mathematically, that, with such engines, employing existing friction drive methods and conventional prop materials, very much bigger diameter drive hubs and prop bosses are required—preferably twice as large. There is, however, another possibility. As we have seen, part (d) of the equation reveals that torque transmission can be increased 100 percent by doubling the number of contact surfaces—as in a double-sided clutch plate. Therefore it would seem to be a wise move to use the prop retaining washer, also, as an additional driving surface.

To do so will require that the washer is *keyed* to the shaft so that, while free to move axially, it cannot rotate. Obviously, the washer should have the same type of driving surface as the propeller hub. (See drawing.)

Fine-Pitch Props

Before leaving the subject of prop drive assemblies, a word of warning concerning fine pitch propellers.

Fine pitch props customarily have thinner bosses than medium and high pitched props. Always check that, when such a prop is fitted, some threads still remain when the prop is pulled up tight. If necessary, add an extra washer between the nut and the prop washer. The same applies when the engine is equipped with a sleeve-nut or spigot-nut type fitting. Check by fitting the nut and prop washer to the engine to make sure that, when the nut is tightened, the space between the prop driver face and the prop washer is smaller than the thickness of the prop boss.

Failure to make these checks may mean that the prop is not fitted as tightly as has been supposed and will slip and, most likely, be damaged when the engine is started.

Balance

In the interests of smooth running, props should not have one blade heavier than the other. Most modern commercially made props are reasonably well balanced, but simple balancing devices are available to enable this to be checked. If necessary, trim the heavier blade until the prop balances, like a wheel, in any position. After trimming, seal the tips of wooden props with a fuel-proof finish, applying to both tips to maintain balance.

Peter Chinn, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

For more information on four-strokes, check out Peter Chinn's Model Four-Stroke Engines, *which covers the history, design, development, and operation of these popular engines. The book is available from* Model Airplane News *for $13.95 plus $1.50 postage and handling. See the* M.A.N. *book ad in this issue for ordering information.* ■

BYRON F-15

(Continued from page 63)

ing gear system flown on the "Striking Back" B-25 models where it supports twice the weight of the F-15. It would take an extremely un-scale arrival to damage this landing gear. A second option is main wheel brakes which are pneumatically operated. These are effective in controlling the taxi speed of the model while allowing for a higher, and therefore, more reliable engine idle. The final option is a functioning dorsal speed brake. This option is a real show-stopper. When the speed brake is activated with the model at rest, the spectators are guaranteed to gasp in astonishment.

The experience level necessary to build and fly a Bryon F-15 is well within the limits of most radio control modelers. The kit is highly prefabricated; thus,

exotic building skills are not necessary, and the flight characteristics can be described as docile yet responsive. Some previous jet experience would be helpful, but not mandatory. An excellent stepping stone to the Eagle is Byron's companion kit, the General Dynamics F-16.

The F-15 Eagle, like many other jet models, is not cheap. The completed aircraft including radio will cost nearly $2,000. When you undertake a commitment of this size you should be investigating several issues: 1. Will the model perform as advertised? 2. Will the manufacturer support the project with spare parts, construction advise and product updates? and 3. Will the manufacturer deliver all that you pay for?

With a Byron Originals kit, each of these questions can be answered yes. This is not just my experience, but it is the experience of every modeler I know who has built a Byron kit.

EDITOR'S NOTE. There should be no doubt that the Byron Originals F-15 Eagle is right up there at the top of the price spectrum in today's R/C kit market with a sticker price of $2,000, but Mark Frankel remains convinced that it's worth the money. We at Model Airplane News *tend to agree but, because it is a costly undertaking, feel that those of you who are going to rush two grand out to Ida Grove for a bird of your very own would appreciate more than a broad-brush review, hence the postscript by Mark.*

With the newness of the F-15 worn off, Mark having repeatedly flown it, we asked him to re-evaluate the project to see if there was anything he might do differently if given the chance. RU

"I'm sure that much of the credibility of the modeling press suffers because so many of the products are reviewed in glowing terms when they really merit more criticism. The F-15, however, is one product that truly deserves high praise. I know that it was an enormous undertaking to design, kit and market a project of this magnitude; therefore, Byron deserves a glowing review for achieving an easily built and easily flown scale replica of the F-15 Eagle.

"You asked if there was anything I didn't like about the kit...and the answer, of course, is yes. Any product of this scope is bound to have some features that can be improved. In fact, one of the desirable features of buying a Byron product, as I pointed out in my review, is that they constantly upgrade their designs. Usually the improvements are easily retrofitted to a completed model.

"The inverted engine installation is something I'd revise since I feel more comfortable operating upright glow engines, especially on a twin. It's difficult working everything through the cheater holes. Also, my dorsal speed brake is showing signs of warping at the aft end, indicating that some framing structure would be desirable.

"These are minor items in a kit that is loaded with exceptional features. I'm so impressed with the F-15 that I plan to build another one next year. I've already selected the color scheme—no, it won't have Day Glo Orange." MF

**The following is the address of the company mentioned in this article:*

Byron Originals, P.O. Box 279, Ida Grove, IA 51445.

The following publications are pertinent to this article:

McDonnell Douglas F-15 Eagle, by James Perry Stevenson, Aero Publishers, Inc. 1978.

Aerofax Minigraph 2, McDonnell Douglas F-15A/B, by Rene Francillon, Aerofax, Inc., 1984.

F-15 Eagle in Action, by Lou Drendel and Capt. Don Carson, Squadron/Signal Publications, Aircraft No. 24, 1976.

Modern Military Aircraft, Eagle, by Lou Drendel, Squadron/Signal Publications, 1985.

F-15 Eagle, Detail and Scale Vol. 14, by Bert Kinzey, Aero Publishers, 1984.

Modern Combat Aircarft 12, F-15 Eagle, by Jeff Ethell, Ian Allan Ltd., 1981.

Koku-Fan Illustrated No. 17, F-15 Eagle, Bunrin-Do Company, Ltd., 1983.

Koku-Fan Illustrated No. 12, F-15, Bunrin-Do, 1983.

Aerodata International No. 13, McDonnell Douglas F-15 Eagle, Visual Art Press Limited, 1980.

Modern Fighting Aircraft, Vol. 1, F-15, by Michael J. Gething, Aero Publishing, Inc., 1983. ■

O.S. FS-40

(Continued from page 41)

opposite rotation on one engine (with, of course, a prop having opposite pitch) to neutralize the effects of torque reaction.

The O.S. factory claims a power output of 0.65 bhp at 12,000 rpm for the FS-40 "Surpass." This is a pretty big increase over the figure of 0.455 bhp at 11,200 rpm that we recorded for a 1981 model FS-40 (see test report in February 1982 issue of *M.A.N.*), but is by no means inconceivable when one considers the improvements that have been made to the new model. A back-to-back comparison of the two engines, on various props, carried out by one of the Japanese magazines, does, in fact, lend considerable support to the factory claim.

Peter Chinn, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897. ■

STIK

(Continued from page 26)

The wing is very easy to assemble, especially since it doesn't require leading edge sheeting or capstrips, yet structural rigidity is assured by incorporating false ribs, turbulator spars, shear webs and trailing edge sheeting. The airfoil is almost fully symmetrical except that the bottom surface is flat from the main spar to the trailing edge so that the wing can be built right on the workbench.

The first step is to glue the notched trailing edge to the bottom sheet and pin it to the board over the plan. The bottom spar is then placed on the plan and the ribs pressed into their respective positions. Next the top spar, leading edge and turbulator spar are added. At this point, cyanoacrylate glue is applied to all the joints to lock everything together. A worthwhile feature is that both the top and bottom main spars are double thickness from the root to the third rib bay for extra strength. I was particularly pleased at the fit and alignment of all the wing parts. The top trailing edge sheet and shear webs are then installed and the wing panel removed from the building board. With the addition of the bottom turbulator spar, false ribs and center section sheeting, the wing panel is essentially completed, and the second one can be started.

The wing panels are then epoxied together using plywood dihedral braces on both sides of the main spars. The fit was excellent and produced the proper three inches of dihedral without any trimming required at the root ribs. The remaining steps are the installation of sheet wingtips, aileron torque rods, wing bolt reinforcement blocks and glass cloth on the center section.

Final assembly tasks include pushrod installation, fuselage top sheet, engine mounting and radio hookup. The radio compartment is large and easy to work in. I am using a Circus Hobbies* JR Century VII radio system. The kit includes a plywood servo tray which I used to hold three JR-501 servos, with the fourth servo mounted in the wing.

The timing of this project was just right for me to try one of the latest O.S. four-stroke engines, the FS-.48 Surpass, imported by Great Planes Model Distributors*. This new engine is claimed to achieve a power level close to that of the earlier .60 four-stroke engines, which puts it on par with a pretty strong .40

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STIK

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two-stroke engine. Although at the low end of the displacement range for the Big Stik 40, the O.S. FS-.48 Surpass delivers adequate power for aerobatics and good vertical climb performance. My Surpass .48 is smooth-running at the top end and has a reliable idle. With the muffler that is included, this engine sure is quiet. Other than normal adjustment of the high-speed needle, I haven't had to change any of the factory carburetor settings. The engine was too big for the motor mount that came in the kit but I was able to use a Tatone* FS-40 cast aluminum mount by filing the bearers a little and redrilling the holes for machine screws with locknuts.

A model with such angular lines as the Big Stik 40 needs an eye-catching color scheme to keep it from looking like a frying woodpile. I chose the World War I German theme, a la Red Baron, always a popular choice for stik airplanes and the version shown on both the kit box label and the plans. Top Flite* Monokote is my favorite iron-on covering material and, by a fortunate coincidence, they had just introduced a Dark Red that could easily pass for Fokker Red. It's hard to beat Monokote for strength, shine and long-term retention. I used both Dark Red and white for the basic colors and made the iron crosses from Monokote trim sheet. The Big Stik is easy to cover since there are no compound curves on the airframe. The only tricky part is the scalloped control surfaces. These were tackled by making many small slices in the Monokote and wrapping each section around the trailing edge using the Top Flite Trim Seal iron.

FLYING. The Big Stik is a fairly large airplane for a 40 class ship, but at 5 pounds, 4 ounces, its wing loading is only 17.5 ounces per square foot, which is ideal for sport flying. That is one of the reasons it flies so well, even with an engine at the low end of the displacement range. Its thick symmetrical airfoil not only permits good aerobatic performance but also gentle slow-flight capabilities, and its stability is further enhanced by the small amount of dihedral. With the relatively low-revving four-stroke engine turning an 11x7 prop, I found that airspeed was moderate and constant throughout maneuvers. It's likely, though, that hot dog fliers would opt for a Schneurle-ported two-stroke .40 or a four-stroke .60 instead.

The Big Stik 40 easily takes off in thirty feet or so, and the rate of climb is only limited by the power available. Looping and rolling maneuvers can be either gentle or abrupt, depending on the amount of control applied by the pilot; and in both cases, the model holds its heading well. Outside maneuvers are accomplished about as well as inside ones, and inverted flight requires just a little down-elevator correction. Like most Stiks, sustained knife-edge flight is difficult to hold since it likes to roll out with application of rudder. This is probably because all of the rudder area is above the stabilizer.

This project was a success from the building right through the flying, and Great Planes deserves a high score for their effort. Their approach to design, materials' quality, and construction techniques pretty much assures the same level of success to anyone with reasonable skills and a little experience.

**The following are the addresses of the companies mentioned in this article:*

Great Planes Model Mfg. Co., P.O. Box 721, Urbana, IL 61801.

NAME THE PLANE CONTEST

Can you identify this aircraft?

If so, send your answer to Model Airplane News, Name the Plane Contest (state issue in which plane appeared), 632 Danbury Rd., Wilton, CT 06897.

The sleek NX21755 is the Vultee Model 48, prototype of the P-66. It's maiden flight was in September 1939. It was powered by the Pratt & Whitney R-1830-S4C4-G, 1,200 hp. Its wingspan was 36 feet, and its length was 28 feet and 5 inches. Empty weight was about 5,300 pounds, with a VMAX around 350 mph. This must have been a very early photograph, perhaps initial rollout, as after a few flights a small scoop was added on top of the cowl. Later on, a conventional cowl was added and a polyhedral wing.

Congratulations to Bob Gerlach of Earlysville, Virginia, for correctly identifying June's mystery aircraft. Other correct entries were James M. Wright and Phil LaRoe.

The winner will be drawn four weeks following publication from correct answers received by postcard delivered by U.S. Mail and will receive a free one-year subscription to Model Airplane News. If already a subscriber, the winner will receive a free one-year extension of his subscription.

STIK

Carl Goldberg Models, Inc., 4732 W. Chicago Ave., Chicago, IL 60651.

Hobbypoxy Division, Pettit Paint Co., Inc., 36 Pine St., Rockaway, NJ 07866.

Circus Hobbies, 3132 Highland Dr., Las Vegas, NV 89109.

Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820.

Tatone Products Corp., 1209 Geneva Ave., San Francisco, CA 94112.

Top Flite Models, Inc., 2635 Wabash Ave., Chicago, IL 60616. ■

SOARING NEWS

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model, taking into account the resolution by the eye of 0.7 minutes of arc. An 8-inch chord would be out of sight above the observer at 3,000 feet, for example.

In the February 1987 issue of RCM&E, there were the results of the Royal Aeronautical Society Lectures at the conference on aerodynamics. Professor Eppler gave the first talk on computer programs modified to predict airfoil behavior of models. Various spans were entered and the wing chord varied on two-meter span models, with the following interesting results: wing chord 10 cm to 15 cm, aspect ratio 20:1 to 13.3:1—provided best lift/drag at one speed; wing chord 15 cm to 20 cm, aspect ratio 13.3:1 to 10:1—optimum for speed and better at high speed; wing chord 25 cm to 30 cm, aspect ratio 8:1 to 6.6:1—better at best glide angle, and *best compromise and best minimum sink value;* wing chord 35 cm, aspect ratio 5.7:1—better over a wide range of glide angles. The low aspect ratio model needs to be flown at higher speed in order to obtain best L/d.

Next, a 3-meter plane was examined and the following conclusions given: wing chord 20 cm, aspect ratio 15:1—highest L/d; wing chord 35 cm, aspect ratio 8.6:1—best minium sink value; wing chord 40 cm, aspect ratio 7.5:1—best range of L/d independent of speed. With a range of 2-, 3-, and 4-meter models, the minimum sink is dependent on span rather than on chord or aspect ratio... which means a big one usually beats a little one. The result has been to increase the chord of F3b models.

Dr. Eppler also stated that surface finish is important, and that a high standard of finish is necessary for speed models (F3b) similar to that required for wind tunnel models, but that for thermal duration and distance, finish is less important. At low speed or narrow chord (Rn approximately 50,000) the thicker boundary layer tends to smooth out irregularities (in surface finish) but the leading edges must still be good. At higher speeds the finish needs to be good because the boundary layer is thin. He also recommends the use of low-taper rations (tip chord divided by root chord), which might be taken to mean that a "plank" wing of almost constant chord is better than a highly tapered wing for F3b models. Professor Eppler also coined a new law: *it should be forbidden to fly at Rn less than 50,000,* an expression of the problems of using narrow chord wings and flying at low speeds.

Other speakers who selected topics of interest to glider folks spoke about the use of winglets, and the fact that they perform

Club of the Month

"Wright Stuff"

The Gastonia Radio Control Club of Gastonia, North Carolina, is our "Club of the Month" for August 1987.

As with most R/C clubs, the Gastonia group is on the lookout for a new field, but none seen to date equals the present location. The club meets monthly, apparently at various members' homes. There is something warm and human in clubs where this kind of meeting procedure is possible. Of course, the club can't have a huge membership.

Field notes in *Wright Stuff*, the club newsletter, showed all the problems and excitement all modelers see on any given Sunday afternoon. Indeed, March 21, the first ideal flying day of 1987, was dubbed "Black Sunday." Six aircraft were destroyed, one drawn down by a tree "magnet," another destroyed by a rock "magnet," and several by the "interference monster."

There are several new rules for '87 for field procedures and frequency control---it all looks very organized and very efficient.

Wright Stuff as edited by Mike Beam is a very readable multi-page newsletter and we congratulate Mike on his fine effort. President of the Gastonia Radio Control Club is David Powers.

Model Airplane News is pleased to award two free one-year subscriptions to this club, which are to be given by them to deserving junior members.

Congratulations!

Each month Model Airplane News will select the club newsletter that best shows the club's activities and energies directed toward the furtherance of the hobby. The award is not based on size or quality of the newsletter, and can be about any aspect of the hobby (F/F, C/L, R/C, boating, cars, etc.). Model Airplane News will award two free one-year subscriptions to be given by the club to outstanding junior members. So send your newsletter to Model Airplane News, Club of the Month Contest, 632 Danbury Rd., Wilton, CT 06897.

well only at high angles of attack and maximum lift.

Martin Simmons spoke about some selected airfoils for F3b, mentioning that the Eppler 193 is a two-speed airfoil, performing well at low speeds but needing to be flown at significantly higher speeds to give best L/d. The Quabeck airfoils seemed to show a much flatter curve, with no two-speed effect. The HQ 2.5 5/9 appears better overall but the HQ 1.5 5/9 looks better at high speeds. This is not surprising considering that the lower-camber generally is less draggy but produces less lift.

Almost rectanglar platforms are being used more often because they have less tendency to tip-stall. Double-taper wings are trickier to fly and produce a lower lift coefficient, but these differences are minor and whatever the pilot is happiest with is of greater consequence. Some would seem to take the view that the more predictable handling is better. The Eppler results were confirmed with regard to aspect ratio, showing that lower AR is best for high speed! Large spans are problems on the speed course (turns) and hence preference for moderate spans of 2.5 to 3.25 meters. Winglets would be best for duration task (as one-speed devices) and the best way to reduce induced drag is to increase span.

**The following are the addresses pertinent to this article:*

Japan R/C Association, att. Hiroyuki Yasui, 224-1 Azima-oku, Tannancho, Hyogo-pref., 669-2, Japan.

Chuck Anderson, P.O. Box 305, Tullahoma, TN 37388.

James Stevens, 25820 Montereina, San Pedro, CA 90732.

Easy Built Models, 15 Ontario, Canada L3M 4G1.

Dayton Area Thermal Soarers, c/o Ken Allen, editor "Glide Lines," 5515 Widgeon Ct., Dayton, OH 45424.

Radio Control Models & Electronics, P.O. Box 35, Wolsey House, Hemel Hempstead, Herts., HP2 4SS, England. ■

GIANT STEPS

(Continued from page 99)

are such woods as maple, oak, walnut, and others used for fine furniture. Softwoods are pine, spruce, cedar, and many others.

Among the best materials for our construction and that of home-built airplanes is sitka spruce. This is a close- and straight-grained wood which has been used in aircraft construction for decades. Lindberg's Spirit of St. Louis had much sitka spruce in it. Pattern pine and even ordinary construction western white spruce and pine can be used if they meet the criteria of being straight-grained. I've used poplar in model construction and like it. It has a long grain and takes bends well while retaining its strength.

Whatever softwood is locally available can be used in model construction. A few pieces of one of these woods in 1-inch thickness will produce a large amount of stick stock for model construction. The use of a hollow ground planer blade on a table or radial arm saw will produce strip stock which comes off the saw ready for use, requiring no sanding or other preparation.

It's possible to cut strip stock down to small sizes but some care must be exercised. I've cut strip stock 1/8-inch square, but cutting strips that small from a relatively hard material risks kick-back in the saw, so the material must be properly retained while it is being cut. Naturally, a sharp saw blade is a requirement. Don't even attempt to cut small dimension stock with a dull blade.

Building from a plan can be a rewarding experience. Even more so when you produce much of the material used in its construction yourself. I hope I've planted a seed or two in the foregoing.

If you keep your eyes open and allow your imagination free rein, there's no reason you won't find new materials or methods yourself. If you do so (or have already done so), let me know and I'll pass the information along.

It is most gratifying to hear from those of you who read "Giant Steps" and even more gratifying to hear you are both enjoying the materials presented and getting some value from it.

For those of you who fly Quadra engines, don't miss Dario Brisighella's book, *From The Firewall Forward.* It contains everything you ever wanted to know regarding the care and feeding of Quadra's line of engines, but couldn't find Dario! The book is available for $12.95 plus $1.50 postage and handling from ViP Aero Publishers*. You'll find good information on props, fuel mixtures, repairs, upgrades, and a gang of other good stuff.

Dick Phillips, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Satellite City, P.O. Box 836, Simi Valley, CA 93062.

ViP Aero Publishers, P.O. Box 16103, Colorado Springs, CO 80935. ■

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WANTED: RTF U-Control planes from Cox, Wen-Mac, Comet, Aurora, Testors, etc., complete or pieces, buy or trade. John Fietze, P.O. Box 593, Lynbrook, NY 11563.

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